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Rural Electricity Supply.

ELSEWHERE in this issue will be found the fourth part of our Symposium on rural electric lines, in which Mr. W. Fennell, chief engineer of the Mid-Cheshire Electricity Supply Co., Ltd., forcefully states the case for the drastic amendment of the existing Regulations. Having carried out many miles of overhead-line construction (and regretfully relegated to the future many more on account of the excessive cost of construction and the difficulty of obtaining wayleaves), Mr. Fennell is exceptionally well qualified to deal with the subject, and as on former occasions when he has taken up the cudgels in a righteous cause, he hits hard and shrewdly.

It appears that the whole system at present in force is radically wrong and needs drastic reform. Electricity supply is just as truly a public service as the Post Office telegraph system, with the difference that it does not cost the taxpayer upwards of a million sterling every year; but whereas the Post Office can erect poles and lines without circumlocution and delay, and takes full advantage of its privileges, the supply authority has to submit its detailed plans and proposals to the Electricity Commissioners (who would probably be glad to be relieved of the task) and await their approval, and has also to defer to the requirements of the Post Office. The Regulations call for guards to prevent loss of life in the event of live wires falling, and those guards in two cases already have been the direct cause of fatalities by shock on low-pressure lines (see ELECTRICAL REVIEW, March 12th, 1926, p. 425, and August 5th, 1927, p. 232)—away with them! Why are not guards specified for 500-volt tramway trolley wires? Wayleaves will hardly bear speaking of; but Mr. Fennell, with eloquence born of heartfelt affliction, reveals the burdens under which the supply authority labours, and he goes on in this case, as well as in his comments on the Regulations for Overhead Lines, to put forward constructive criticism and practical sugges-

tions, the adoption of which would mark the commencement of a new era, and add years to the life of the long-suffering engineer.

Whilst on this subject we would draw the attention of managing and constructional engineers to the proposition submitted by Mr. R. Borlase Matthews in our last issue (p. 326)—that engineers experienced in such work should form themselves into an "Overhead-Lines Club." Such a body might conceivably fulfil many useful purposes: it would reveal the members to each other, serve as a medium for the exchange of information, afford a measure (like the old "Point-fives Club") of the progress made, and, above all, enable those interested in overhead-line construction to convey their collective views and needs to the Electricity Commissioners, who would surely welcome its formation. At present there is no fully representative body to deal with the case of the overhead-line engineers. The I.E.E. and the I.M.E.A. have set up committees, but neither of these bodies in the main is intimately concerned with the subject, and neither has a free hand. The protests uttered from time to time by individual engineers against the restrictions from which they suffer fall on deaf ears, but if they were the considered opinions of a body of experts they would command attention.

One thing is certain—so long as the matter is left in the present hands no progress will be made. We wish the Electricity Commissioners would hold a public inquiry into this most important subject and take the evidence of those who do thoroughly understand the work. Unless some such step is taken, the general extension of electricity supply into rural areas, which formed so prominent a feature of the Government's scheme (but did not appear in the Bill and was not perceptibly furthered by the Act of 1926), will remain a dream of the distant future.

Combines in the Electrical Industry.

The number of recent cases in which public authorities have placed orders for electrical material abroad, not so much on account of the lower prices as to protest against the existence of a "ring," has called forth from the B.E.A.M.A. a weighty treatise in defence of industrial combination.

The monograph "Combines and Trusts in the Electrical Industry" does not lend itself to adequate review; we have therefore had to content ourselves with a brief survey of the salient points in our later pages.

It presents a very powerful argument in favour of agreements relating to production, prices, and markets between firms which would otherwise ruin each other by over-production and uneconomic selling—for the benefit of alien manufacturers. The authors maintain that British goods are the cheapest in the end even if initial prices compare unfavourably with those of foreign competitors, and they state that without a serious attack upon wages and conditions British manufacturers cannot possibly reduce their prices to the Continental level. The reader is assured that the British electrical industry has reached such a state of efficiency that there is very little hope of bridging the gap between its prices and those of foreign producers by improvement in methods. The principal moral pointed out is that if purchasers who go abroad for their requirements are really only aiming at eliminating combination between British manufacturers, they are fostering combines which not only employ far stronger methods, but are able to keep British manufacturers out of their home markets by influencing the imposition of tariffs, by controlling electricity supply undertakings, and by many other means. It is held to be impossible to place an order abroad without supporting a "ring" or combine of some kind. One part of the monograph is a mild attack upon electricity supply authorities: it is said that no matter what concessions are granted by manufacturers, there is no guarantee that the ultimate consumer will receive the benefit of them. A real lowering of retail prices would stimulate the market and broaden the basis of production.

There are a great many other points supported by a mass of facts and statistics, and the opponents of the B.E.A.M.A.'s policy will find it hard to present a convincing reply, although there are one or two directions in which an opening occurs.

The conclusion is reached that the only alternative to a stronger combination between themselves is for the members of the British electrical manufacturing industry to form closer associations with German and American groups, ultimately being absorbed in the inevitable international combine.

We presume that the publication is intended primarily for municipal electricity committees, as these have been the principal bodies in ordering electrical plant from abroad. This being the case, we expect that free copies will be sent to the committees of leading towns. If not, we consider that an abridged version or abstract should be produced, for the committees will certainly not spare the time or provide the money for the bulky volume as it stands at present.

The monograph should interest other large bodies whose contracts are not always advertised, as are those of municipal undertakings, and who do not always "Buy British goods."

Domestic Water Heating.

It is often alleged that the heating of water by electricity from public supply mains is not a practical proposition, on account of its excessive cost, and it is true that this matter should be approached with circumspection; but, as usual, there are two sides to the question. As Mr. John H. Parker, M.I.E.E., points out in the interesting article which appears elsewhere in this issue, to deal with it in the wrong way leads to disaster, but with judicious handling domestic water heating can be made a brilliant success. The time-honoured methods that were good enough for heating water with coal are not suitable for adoption with electrical heating, and the conversion of existing hot-water equipment to electrical operation, without at the same time taking steps to prevent waste of heat, results in an excessive consumption of electrical energy. The late Mr. C. Orme Bastian, amongst others, investigated this subject very closely, and arrived at similar conclusions to those explained by Mr. Parker, which will be found worthy of careful consideration.

But, apart from the technical aspect of the subject, a very important economic question is raised by Mr. Parker, which demands the attention of all electricity supply managers who will be called upon to take bulk supply in the not-distant future, as well as of the Central Electricity Board itself. As the author points out, the very low off-peak tariffs which can be quoted for heating water during the night, on the basis of individual load factor, with advantage to both consumer and supply authority, will no longer be practicable when the authority is required to pay for electricity on the basis of its average load factor. This is a very serious matter, and it is desirable that, if possible, it should be considered before the Board commences commercial operations.

It may be observed that, whilst the Act of 1926 prescribes the mode of framing the tariff for bulk supply to authorised undertakers, to consist of a "fixed kilowatt charges component" and a "running charges component," authority is also given to the Board to frame the tariff "in such other manner as may be determined by an order of the Electricity Commissioners," subject to the veto of either House of Parliament. Hence, if a system of charging can be devised which overcomes the difficulty indicated by Mr. Parker, it will be possible to bring it into operation without further legislation.

The very essence of the Act and the policy which it is intended to embody, is the improvement of the load factor of the main generating stations. One of the most effective ways of attaining that end is to develop a large night load, and domestic water heating, though little practised at present, offers enormous scope for development if it is encouraged by a suitable tariff. If, therefore, this valuable outlet for off-peak supply is blocked by a hard-and-fast system of charging which does not take account of the peculiar advantages of the cheap night load, the operation of the Act will be gravely hampered. It may be remarked that if the night load is adequately developed by the distributing authority, the latter's load factor will be correspondingly improved, and it may eventually be possible to supply the load at economic rates without going outside the general tariff; that is true, but such a demand cannot be created in a year or two, and in the meantime some relief is indispensable. Would it not be possible for the Board itself to frame a special night tariff on the same lines as are followed by existing undertakings? As we have indicated, it is at least as important for the Board to encourage a night load as it is for the local authority to do so, and if assurance is given now that a practicable tariff will be offered, station engineers will be able to develop such a load with that confidence which will otherwise be lacking.

Battery Eliminator Circuit Risks.

THAT "broadcast from the mains" will be a feature of the coming season is a certainty; battery eliminators are being put on the market by manufacturers in increasing numbers, both for a.c. and for d.c., and development in that direction is a natural corollary to the growing use of valve sets and loud-speakers. The time will come when the radio set will be as much a part of the furniture of the sitting-room as the piano used to be, and when it will be plug-connected to a socket fed from the domestic electricity supply mains just like a radiator or a fan.

But a word of warning is here necessary. Whilst we deprecate the scaremongering attitude adopted by some electrical engineers towards portable electric apparatus used in the living-room, we pointed out some years ago that there was a real risk in wearing headphones whilst handling other electrical apparatus, as through faults occurring the former might be earthed and the latter alive; a fatal accident which was recorded in our issue of June 3rd last (p. 870) justified our forebodings. The battery eliminator used in conjunction with a loud-speaker offers no new risk; but if, for any reason, headphones are used, the danger above-mentioned is incurred in an aggravated form. The 'phones are practically clamped to the head, often making good contact between the skin and the metallic parts, which may easily become live through a fault in the wiring (which not infrequently develops, without materially affecting the operation of the instrument); other portable electrical apparatus, if wired according to the latest I.E.E. Regulations, is earthed, and thus the stage is set for tragedy. Other conditions may readily arise which are equally dangerous—for instance, the headphone frame may be in contact with the earthed pole of the supply circuit (through the eliminator), whilst the live pole is exposed through a fault in a fitting or appliance.

As we have pointed out, the safe course is to insert a transformer between the headphones and the receiver; series condensers (on both poles) serve the same purpose. The manufacturers of battery eliminators also should take precautions in the design of their apparatus to obviate this serious risk. Apart from the "safety-first" aspect, the provision of an output transformer is often desirable, and in the case of the use of certain types of loud-speaker essential, if good reproduction is desired.

The Almeida Storage Cell.

ELSEWHERE in this issue we give the substance of a number of references to the "Almeida neutral system of accumulators," an invention which appears to be regarded with favour by our Spanish contemporary, *La Energia Electrica*, but is adversely commented on by the A.F.A. (makers of the Tudor accumulator in Germany). The claims put forward on behalf of the new cell are startling, but that is not unusual in such cases. In the absence of any definite information regarding the details of the Almeida accumulator, and of the results of tests to which it has been subjected, it is, of course, not possible for any expression of opinion as to its merits or demerits to be given, and we must perforce confine ourselves to a summary of the information which has become available to us from a variety of sources.

The path of the inventor, especially when it leads in a direction implying a radical departure from previously accepted practice, has ever been a thorny one, and past experience with regard to "revolutionising accumulators" has disposed us, and electrical engineers in general, to be somewhat sceptical; but there is no doubt that finality in storage battery construction is still a long way from attainment, and that a fortune awaits the man who can achieve even a fraction of the improvement claimed for Father Almeida's cell. That he has produced an interesting accumulator is apparently undeniable; but whether he has produced one that can show advantages in actual practice under normal working conditions over the types with which we are familiar remains to be demonstrated, and the A.F.A. statement on this head must be regarded as highly significant.

A Royal Example.

WE note with interest and much pleasure that H.R.H. the Prince of Wales is setting a good example to farmers by installing electricity on his Grove Farm, near Nottingham; it is stated that the completed scheme will provide for 110 electrified points on the farm, and the farmhouse will be fully equipped with up-to-date electrical apparatus.

This installation, by virtue of the extended publicity that it will receive, will do more to attract attention to the benefits that farmers can derive from the use of electricity than all the propaganda methods that are available to electrical men, and we hope that it will be carried out with the best advice and on the soundest lines, so that the maximum advantage will result both to agriculturists and to the electrical industry.

London Tube Breakdowns.

THOSE who reside in the Metropolitan area cannot have failed to notice that the underground electric railways have suffered this year from a succession of disturbances which have imposed a good deal of inconvenience on a large proportion of the regular travellers, who now number some 400 millions a year. Since January 1st there have been nine notable derangements of the system, several of which were due to the failure of electrical apparatus or cables.

Our sympathies are with the Companies, which have every reason to desire the maintenance of the service without interruption of any kind, and spared no effort to restore normal running as quickly as possible; in view of the congestion on the surface, it is most important to maintain the reputation of the railways for reliability and punctuality, and to attract passengers to the Tubes in order to relieve the traffic in the streets.

Whether the recent mishaps have been due to the effects of age or overwork, or merely to a run of "bad luck," we do not know, but it is to be hoped that every care will be taken, by frequent and searching inspection and testing, and by the supersession of worn-out machines and apparatus, to forestall such occurrences and to protect the good name of the railways concerned, for the sake of both the public and the shareholders.

Hotel Electrical Equipment.

The May Fair Hotel, London, which occupies the site of the northern end of the garden of old Devonshire House, covering approximately an acre of ground, is, with the exception of central heating, "all-electric"; some interesting features of the installation are described below.

By V. C. HARDY, Chief Engineer, Gordon Hotels, Ltd.

ALTHOUGH the principal features of electrical installations in large mansion flats and hotels may be said to have some points in common, the requirements of the latter are much more complex and numerous. When the May Fair building was taken over for use as a hotel, it was in the main an incomplete steel framework, but the main wiring scheme for feeding the flats, for which the building was first designed, was in hand. In order to use this arrangement as far as possible, the floors of the proposed hotel were divided into five sections for electrical distribution purposes; a set of feeders is taken in from the street direct to the first floor, where are situated the cut-outs and meters for the various sections. Section cables then rise to feed the distribution boards of the floors directly above. With this system each section is fed independently from outside, and less main wiring is used by not running back to the main switchboard; further, the current consumption in each section can be checked and the control is simple, the section switches, and so on, being housed on the first-floor corridor. Against these advantages there is the large number of meters.

Fig. 1.—May Fair Hotel.

The chief requirements for a large hotel system are simplicity of lay-out, to ensure easy maintenance, and a wide margin on the main cables to allow for future expansion; as almost everything is done by electricity, the large consumption usually results in reasonable rates. An interesting factor in the May Fair Hotel, fig. 1, is that no gas whatever is used on the floors; electric fires are provided for the visitors, and all operations such as cooking, refrigeration and ironing carried out on the floors are done electrically, the feeders being of ample capacity. With regard to the lighting of the large public rooms, each has an independent main going back to the section distribution board. To comply with the L.C.C. regulations, a secondary supply serves all the licensed portions of the building, and is used as a convenience in the corridors and other places.

Turning to the power requirements, in order to ensure that all the motors shall run as silently and free from vibration as possible, a d.c. supply is brought into the hotel at various points.

The wiring was undertaken for the general contractors, Messrs. Edcaster, Ltd., by Messrs. V. G. Middleton & Co., Ltd., who carried out the work very well and were always up to date. C.M.A. cable in screwed steel barrel was used throughout.

Each room is fed direct from the distribution board in its section and is wired in two circuits, in case a local fuse should "blow." Fig. 2 depicts the lighting arrangements in the bedrooms. Over the dressing table is a two-light fitting, pendant or bracket, while in the centre of the room is a fitting for the main lighting of the room; these two points are controllable by two switches, one at the door and one by the bed. The lavatory basin is provided with a small bracket controlled by a separate switch, and over the bed is a bracket independently switched near by. The fitment wardrobe has a bracket fitting over it which is operated by opening the door. In every room there is a 15-A plug and switch for an electric fire, which also serves for the vacuum-cleaner feed. A 5-A lighting plug also exists. The

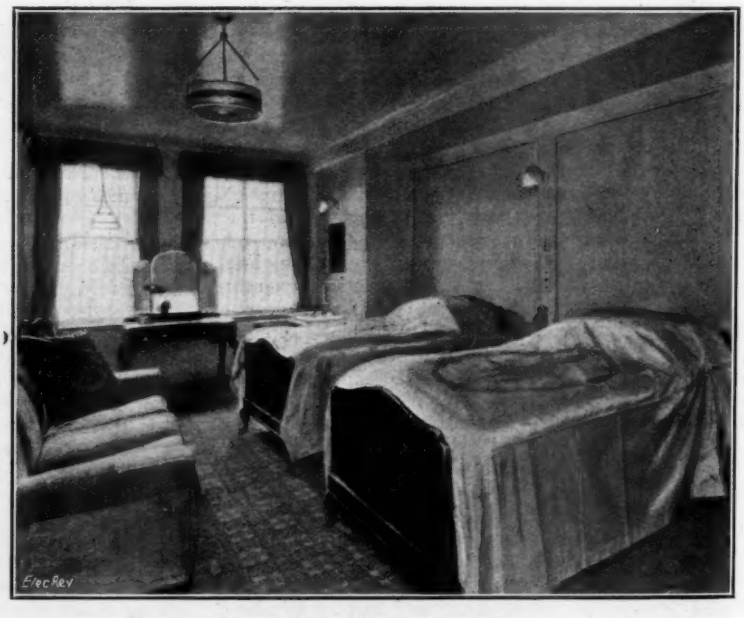

Fig. 2.—Bedroom Lighting Arrangements.

power and light in these rooms come off the same distribution-board bus-bars, 15-A fuses being arranged at one end, and smaller ones at the other end for lighting.

The corridors are supplied from the various sectional

distribution boards, and 15-A plugs are provided at convenient points for such apparatus as vacuum cleaners, floor polishers, and paint-spraying machines. All the maids' and valets' services have power plugs, in the latter case for clothes pressing, &c. Each waiter's service is further equipped with an electric grill and a refrigerator. On each floor is kept a stock of electric fires, table lamps, and irons for the use of visitors who require them. At certain points on each floor, such as at the junctions of the corridors, emergency points are taken off the secondary supply.

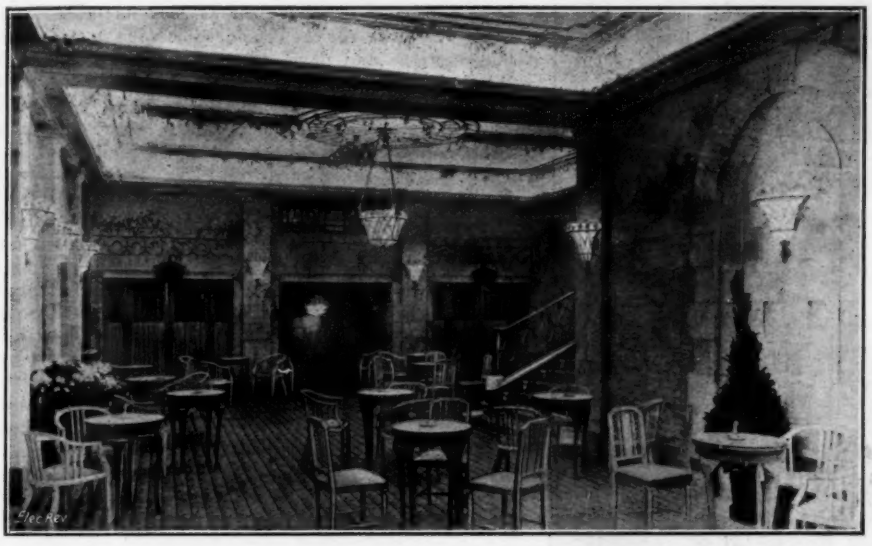

Fig. 3.—Lighting Fittings in Grill-Lounge.

The lighting of the main and lower ground floors is carried out from a double-panel main switch-board situated near the boiler house and engineering department. The supply feeders come in from Lansdown Passage to this board, *via* the supply company's cut-outs and meters. The board was made to specification by Messrs. Johnson & Phillips, Ltd., and is of black slate carrying the necessary fuses and d.p. switches for the circuits. Ammeters are supplied for each circuit or group of circuits, and each panel is equipped with a voltmeter. The circuits from this board are taken through ironclad switch and fuse boxes.

The main supply is taken from the Westminster Electric Supply Corp., Ltd., at 200 V, single-phase, 50 cycles. The Corporation has a sub-station in the building from which it supplies the neighbourhood with l.p. current, ring mains being arranged round the building.

Adjacent to the main lighting board is the secondary supply board which receives energy from the London Electric Supply Corp., Ltd., h.p. feeders enter the building from Curzon Street to a small transformer station. The supply conditions are 200 V, single-phase, 85 cycles. From this board the wiring is taken to ironclad distribution boards. The main d.c. supply (400 V) enters the building from Lansdown Passage, and feeds a single-panel power board by Messrs. Johnson & Phillips, for the ventilating plant, pumping gear, &c. Alongside this board is a 200-V, d.c., 100-A intake for arc lamps, spot lights, kinema, and so on, and leads are taken to points convenient for serving either or both the ballroom and restaurant. The power for the lifts is taken into the building at the points where the lifts or batteries of lifts are situated, each intake having its own meters and cut-outs. There is a small auxiliary 400-V d.c. board supplying the battery of service lifts, and also the kitchen plant, consisting of washing, ice, and burnishing machines, and so on. The larger types of refrigerators in the kitchen and wine cellars are "Autofrigor" machines, supplied by Messrs. Richard Crittall & Co., Ltd., and use 3-phase current; for this a small supply, about 7 h.p., is taken direct from the Westminster Corporation's sub-station, 200 V, 50 cycles, a small three-phase board being provided near the kitchen.

Returning to the lighting schemes, all the bedrooms and corridors have simple fittings of champagne-coloured glass, decorated with floral designs; these were supplied by Messrs. Maple and Co., Ltd. Some very special schemes of lighting have been carried out in the sitting rooms, utilising both centre fittings and standard lamps supplied by Messrs. Osler and Faraday, Ltd., and the Edison Swan Electric Co., Ltd. On coming down into the hotel lounge, there are to be found some unique coloured-glass fittings flush with the ceiling, an arrangement which was adopted chiefly on account of the lowness of the ceiling; further, some very attractive brackets may be seen in the grill-lounge, fig. 3, and on the stairs. The credit for the design of the fittings mentioned is due to Mr. C. E. Muggeridge, who is also responsible for the magnificent silk fitting in the restaurant, and the standard lamps there and in the lounges.

Fig. 4.—Ballroom, Cornice Lighting.

The main lighting in the restaurant, ballroom, fig. 4, restaurant lounge, fig. 5, and reception room is concealed in the cornices and round the rims of the glass skylights. In the restaurant the subdued colouring required is

obtained by sprayed lamps, and all the lights can be operated through dimmers. All this lighting is on the same principle, porcelain enamel reflectors being used with 20-W sign-type lamps at 4-in. centres; the lamps are arranged alternatively on the two circuits, primary and secondary. The glass skylights can be illuminated externally by means of floodlights situated between the

Fig. 5.—Restaurant Lounge.

domes and the outside roof pavement light. Downstairs in the garden grill room, fig. 6, a good lighting effect is obtained from hanging basket fittings and cornice lighting, while the hand-painted walls are illuminated by a special form of inverted cornice light. The concealed-lighting apparatus for all these rooms was provided by the General Electric Co., Ltd. All the service and office parts of the hotel are lit by a very simple type of fitting designed by the engineer and supplied by Messrs. A. C. Hands & Son. It consists of an inverted porcelain - enamelled metal reflector screwed to a ceiling ring and used in conjunction with a white opal type of lamp.

While on the subject of lighting, mention should be made of the internal signs; these are chiefly directional and of the "Internalite" type manufactured by the K.F.M. Engineering Co., Ltd. A large sign outside the building, fig. 1, is of the "Dayanite" type. On the canopies over the doors are small gilt-lettered signs, supplied by Boro' Electric Signs, illuminated by small 12-V lamps, which are fed from a small transformer situated in each case behind the canopy.

Internal communication is established throughout the hotel by G.P.O. telephones, extensions being provided in every room, service, office and other convenient points, making about 500 in all. A main switchboard under the charge of three operators is served by 40 exchange lines. There is also a bell system on all the floors for communication between the rooms and the services; a buzzer in each section denotes the section from which the signal is sent, and a lamp outside the door indicates the room requiring service. This method eliminates many bells and pilot bells, thus making for silence. The signalling system is supplied from a separate transformer at 25 volts; this pressure is used to allow for the considerable voltage drop on the long sections and down to the manager's office, where "tell-tale" lamps remain "on" as long as calls are unanswered in the corresponding sections. The wiring for this system was carried out by Messrs. Edcaster's electrical section.

The main power board, built by Messrs. Johnson and Phillips, Ltd., is placed near the other boards under the control of the engineer-in-charge. From it are fed the exhaust and plenum fans, 40 and 35 h.p. respectively, of the ventilating system, and the pump motor for the air conditioning and washing plant. The auxiliaries in the boiler house are also fed from the same source; they include an Allen centrifugal pump for boosting the water board's pressure, should it drop, feed pumps, and accelerators for the central heating system.

In addition to the main refrigerating units already referred to, the waiters' services, still rooms, and so on are equipped with "Mechanical" refrigerators.

Fig. 6.—Garden Grill Room, Basket Fittings and Cornice Lighting.

Domestic Electricity in Switzerland.

Heating by electricity has enormously grown in favour in Switzerland, and recent statistics furnish interesting details as to the progress made in this direction. At the end of 1913 there were 91,000 different installations in existence for heating purposes. Thirteen years later there were as many as 1,040,000 appliances used for domestic purposes. Included in this figure were 100,000 electric stoves and hot plates, 150,000 electric tea and coffee pots, and 500,000 electric irons (65 for every 100 families). In addition there were 100,000 radiators, 40,000 electric boilers, electric foot-warmers, electric compresses, and many other useful inventions.

Rural Electric Lines.—IV.

A Symposium of the opinions of electrical engineers experienced in the construction of overhead lines in rural areas, with examples of methods that have been, or are to be, adopted for the distribution of electricity at low and medium pressures.

THE following contribution to this series of articles* may be described as a human document, indicative of the author's experience and of the need for bringing to a speedy end a situation which, if it were not so serious, would have furnished the late W. S. Gilbert with abundant operatic material.

The author, who is the general manager and engineer of the Mid-Cheshire Electricity Supply Co., Ltd., which operates an extensive overhead transmission and distribution system, deals with three phases of the subject: first, the preliminary obstructions which engineers who attempt to develop such a network have to overcome before they can commence their work; secondly, he treats of the technical aspect of the subject, showing what has been done, the difficulties that are encountered, and what might be done if proper regulations existed and adequate facilities were available; thirdly, he cites examples of rural work.

Country Lines.

By W. FENNELL, M.I.E.E.

Another season has passed and nothing has been done by those in authority to assist us in dealing with outer suburban and rural electrification. We have still the Electricity Regulations drafted by an eminent transmission engineer to suit trunk lines, and have to comply with them when planning village distribution; the Post Office still finances its lines to some extent at our expense when they follow ours; we are still held up by local councils, by landowners, and by tenants, because we dare not adopt the cumbersome procedure of the Electricity Commissioners. They have been known to take six months to hold a local inquiry and to give their decision as to whether a country line should be overhead or underground when everyone, including the Commissioners, knew it *must* be overhead. There has, however, been a great advance during the last twelve months in all but the official attitude. Large power companies, which a year or two ago scorned overhead work, have been forced to consider it as a cure for cable failures at 33,000 volts; they have also been induced by public interest, aroused by the 1926 Bill, to consider extensions into their country districts.

The building boom in outer suburbs and country places has produced a real demand from people who are spending as much as they can afford on their country houses and are anxious for the electricity authorities to supply them, rather than spend £150, or more, on a private plant. The result is a change of spirit and a quickening of interest, not only on the part of the smaller undertakers, but also on that of the large ones. The writer, having recently carried out the complete electrical equipment of an area of 120 square miles, including four towns and many villages, has been surprised at the number of engineers who have taken an interest in his doings. Speaking quite frankly, the question arises: shall this equipment be made useful to its fullest extent by extending secondary lines to the more distant villages and hamlets and farms, or shall it be reserved for the near-by consumers? Unless the scheme is completed, the local public will consider, and rightly so, that Government talk of rural electrification is nothing more than another terminological inexactitude.

* Previous articles were published in the ELECTRICAL REVIEW of July 15th and 22nd, August 5th and 12th, 1927.

The Present Position.

It is proposed to follow the track of an engineer who, being a "live wire," has persuaded his committee or board to embark on a policy of radial expansion within its existing area of supply to the outer suburbs and the country beyond. It will be decided that overhead work is essential to enable the line to pay within, say, three years, which means that the annual income must equal one-fifth of the capital cost of the extension. Presuming that the gross profit is half the receipts, there will then be an annual margin of 10 per cent. of the outlay wherewith to defray administration, rates and taxes, depreciation, and interest charges.

While undertakers may carry out underground work by giving notice to the road authorities concerned, they may not erect overhead lines without the consent of the Electricity Commissioners, who decree that, as a condition of consent, the undertakers must not merely carry out the regulations, but must also get the route and the actual engineering details of construction approved by the Commissioners in advance. We thus come to the first stage of what may be likened to the old and rough schoolboy horseplay of "running the gauntlet." The whole attitude of those who administer the Electricity Acts is to encourage underground work and to look upon overhead work with suspicion; consequently, those connected with it are watched, harassed, and obstructed in every possible way. This is the natural attitude of a conservative people in a country where vested interest is strong. We, as engineers and managers, have no concern with the political aspect of the question: we can only state the facts, and face them.

The real offence of overhead work is the fact that it is an outward and visible sign that the individual must suffer some slight inconvenience in the interests of the community. This is not recognised in Britain, and we have references in the Acts to "amenities," to danger to the public in consequence, and a procedure which discourages resort to the compulsory powers tardily and grudgingly given. So long as we supply electricity in such a way that only the roads are dug up and an indefinite "public" is the only sufferer, we have an easy passage: the public is accustomed to this form of inconvenience—but the moment we come out of the ground the struggle commences. There is, moreover, an idea that the Government is the only authority allowed to use the road side for the erection of poles, &c. This idea has been encouraged by the privilege given to the Post Office for many years past, a privilege it has used to such effect that the verges are almost unusable by reason of its poles. The æsthetic argument is, literally, so much eyewash. The Post Office lines are ugly beyond words, far more offensive than anything we can invent. They are rarely criticised; they are "Government," and therefore inevitable. The same attitude applies when the Post Office makes outrageous claims and demands upon us; the Government, again, must not be inconvenienced, even when we are there first. The common law of the land, which gives to every lawfully established occupier the privilege of undisturbed and peaceful possession, is, in fact, reversed against us when the Post Office is concerned.

The facts are there, and the only safe course is to recognise the situation in any endeavour to alter it. After all, every movement for betterment in this country has had to face the same situation. For example, rail-

ways were treated in the same way, motor-cars were prohibited for years after they were running on the Continent, and even to-day every driver of a motor-car is presumed to be a miscreant unless he can prove the contrary, and he is subject to licensing, the fee being just a little less than for a dog! Every driver of a horse vehicle is a free man, having behind him all the force of the British constitution, which presumes a man (not licensed) to be innocent until he is proved guilty. As the motor-car is to the horse, so is the overhead line to the cable, and there we have it. It is swifter, more efficient and available to the man of moderate means, more flexible and a better proposition; but it is new, it does not eat oats, and therefore it is to be obstructed. The motor-car has triumphed over the horse, and we must be as persistent as the motoring pioneers were and face the music. A form of electrical transmission which costs half that of the cable, is less expensive to maintain, and is more reliable and flexible, is bound to triumph for country work even in a conservative country, if only because we are, as a nation, short of cash. We have only to show ourselves tenacious and worthy of the "British bulldog breed" to turn even our present enemies, sportsmen after all, into belated, but still genuine, admirers of grit, and the overhead lines which grit is producing.

Having, it is hoped, realised that he is "up against it," the engineer submits the plan, fills up a form containing questions as to the length and diameter of poles, spans, height of insulators, &c., and *waits*. The Commissioners' staff check the figures, and the engineer often receives, after a month or six weeks, a note which says, in effect, that in a gale of 60 m.p.h. when the line is covered with ½ in. (radial) of ice, the lower, *i.e.*, the return line, or earthed neutral, would be only 19.36 ft. above ground, instead of 20 ft. in one or two of the spans, and the line does not comply with their rules. The Commissioners visualise a level country, without valleys, not even a dip of 0.6 ft. between poles. Having given an undertaking to use longer poles, or to reduce the span, another paragraph in the same letter has to be dealt with, *viz.*, the Commissioners require evidence of the approval of the local authority. An unsuccessful attempt was made a year or two ago to persuade the Commissioners to themselves notify the local authority of the application, telling it that its consent is not necessary, stating that the case appears to be one for overhead work, but, if the local authority has any representations to make, the Commissioners will hear them. This is what the Act says, and what it means, but the engineer has to go unsupported and ask the local council for that approval which the 1919 Act abolished. While Rural Councils, anxious to have electricity and surprised to find it really may become available, give their approval without much trouble (except that they show a tendency to prohibit the use of the road side) almost every Urban Council objects on principle when it thinks it has a power of veto; also, it feels that its dignity as an urban district suffers, even if the line crosses fields, and so the engineer starts letter writing to fit in with monthly meetings. If the clerk is experienced in the gentle art of obstruction, three or four months go by at this stage. At the same time, the engineer will approach landowners (some of them councillors) who take their cue from the Council's opposition, and he will probably have to choose between (1) a local inquiry, including a further three to six months' delay; (2) the payment of heavy wayleave rentals to landowners; (3) running underground; (4) abandoning the line; (5) persuading the consumers who want the supply to use their influence on the Council and with landowners, pointing out the fact that he cannot go underground. Personally, the writer objects to course 2, for it makes the next line more difficult, as the "news" spreads; course 3 is impossible in most cases; course 1 takes much time and leaves a bitter feeling behind it, for the cost of an inquiry is heavy, and has to be paid by someone; moreover, the delay is very great. Unless the engineer can use the influence of intending consumers, he will be advised to drop the proposal.

The 1926 Act, which has done nothing for distribution, has actually added yet another authority (the County Council) which has the right to be heard when a line is to cross a county road. Why an authority having only surface rights and interested entirely in preventing the surface from being dug up, should be put into a position of objecting to its not being dug up is a mystery to the writer, but we have that extra handicap, and the engineer must remember to write to the County Council and ask for its approval also. Even when the Councils approve, each landowner considers he is in a position to delay us, if not to block our scheme, and he considers also that withdrawal of his veto is really worth a substantial douceur. The writer was told by one owner that he wanted 10s. per annum per pole, failing which the Rural Council, on which he sat (in more ways than one), would oppose the line! Again, some owners consult their solicitors, who run up bills of costs and make their payment a condition of advising their clients to grant the wayleave. All this time the intending consumers are agitating for their supply.

Solution of the Problem.—It is easy to overcome the difficulty: carry out Section 21 of the 1919 Act literally, and as intended by Parliament:—(*a*) The undertakers should apply to the Commissioners for permission to erect an overhead line (without sending constructional details), the application to show the general route and to state the purpose and voltage of the line; (*b*) the Commissioners should examine the route on the Ordnance sheet, at least, and decide whether it is, *prima facie*, reasonable that the line be overhead; if they agree, as they nearly always do, then (*c*) the Commissioners should write to the local authority and the County Council stating that they propose to sanction the line, unless the Council raises definite and reasonable objection within one month; if the Council's objection appears to be of weight, a Commissioner or a technical assistant can go down and see for himself and decide there and then or within a few days; (*d*) in the meantime the engineer can send such technical details as are required from time to time to enable the Commissioners to sanction the line from the technical point of view, if they give their general sanction for a line to be erected.

Wayleaves.

The author's method of dealing with the wayleave situation may be judged from the special form of notice reproduced below:—

COPY.

WAYLEAVE AGREEMENT FORM.

MID-CHESHIRE ELECTRICITY SUPPLY CO., LTD.,
Electricity House,
Town Bridge,
Northwich.

To ——————————

Dear Sir,

We give notice as required by Section 22 of the Electricity (Supply) Act of 1919, of our intention to place an electric line/cable over/on your land situate at..... approximately in the position indicated below.

We offer the following standard conditions, which provide the necessary safeguards to owners:

1. The Supply Company shall pay the cost of repairing any damage caused by such electric line/cable or by its employees erecting, maintaining, or removing the cable/poles, stays or lines.
2. The Supply Company shall pay an acknowledgment or rental of 1s. per annum per 100 yards of underground cable or per pole or bracket with or without a stay and wires attached, fixed on your land, to date from..... 1st, 19....., payable yearly in advance, provided always that no rental shall be payable in respect of poles, supports, or stays for service lines/cable required for a supply to your premises or those of your tenants.
3. The Supply Company shall, on receipt of written notice that a pole or line/cable is in the way of any works to be carried out by the owner, arrange to alter or remove the pole or line/cable to a new position at its own cost, so that the work may proceed.

4. This wayleave may be terminated by you at any June 30th or December 31st on giving 6 months previous notice, in writing, provided always that the Supply Company retains its powers under the Electricity (Supply) Act, 1919, to apply to the Ministry of Transport to continue the wayleave on such terms as the Ministry may think just.
5. At the termination of this or any extended wayleave, the Company shall forthwith remove its property and efficiently make good after such removal.
6. In the event of any dispute arising under or in connection with this wayleave the same shall be referred to an arbitrator appointed by the Ministry of Transport.

We shall be much obliged if you will sign the annexed consent, and return it to Electricity House, Northwich, retaining this copy as a record of the conditions under which the wayleave has been granted.

Signed——————————*Secretary.*

Date——————

MEMO:

.....yds. of cable at 1/- per 100 yds. £ : : .
.....poles, &c., at 1/- each ... ... £ : : .

Total £ : : . payable.....

In order to simplify bookkeeping, payments will date from January 1st or July 1st, whichever is nearest to the date of commencement of work of erecting the poles, &c., referred to above.

The wayleave itself (not reproduced) is printed on the opposite sheet, and repeats the standard conditions with the necessary wording as a form of acceptance. This has the advantage of securing standard conditions by avoiding "agreements," which always lead to bargaining. The standard conditions contain every safeguard which any owner could desire. The notice is dated, and has a space for a small-scale plan, so that after three weeks we can refer to a possible compulsory wayleave. It may be some testimonial to the efficiency of procedure by notice to say that wayleaves covering 25 miles of e.h.p. line have been obtained at 2s. per "A" (or double) pole, and fully that length of single-pole line at 1s. per pole. There has been no appeal to the Commissioners, except in one case of a railway company. By firmness and patience, we have now established this local standard rate, and it is almost inconceivable that, for normal positions, it would be exceeded on appeal to the Commissioners. It would be true, however, to say that we have been delayed and driven to the verge of appeal many times. It would, in the writer's opinion, have been a very wise proceeding if the first clear case of unreasonable refusal, or of excessive rental demand, had been taken to the Commissioners, as many owners still persist in considering that our reference to compulsory wayleaves is mere bluff. As it is, the delay in obtaining wayleaves is so serious that there is every temptation to alter a route, or to pay more, in the mistaken hope of easing matters and getting on with the work. Once this is done, the news spreads, and almost every owner in the district obstructs in order to secure the same happy result. The remedy for this state of things is that the Commissioners should quicken up the appeal procedure, so that we can secure the benefit of improved wayleave facilities which the 1919 Act purports to provide.

One matter needs attention in the next Electricity Act, namely, the fact that the power of the Ministry of Transport to grant a compulsory wayleave for overhead lines under the 1919 Act does not extend to a "garden or pleasure ground." One does not want to place overhead lines in unreasonable positions, but the back garden is the best position, even from the owner's point of view; in any case, the Ministry of Transport ought not to be debarred from dealing with *any* position: it need not grant the wayleave if the owner would be injured thereby. For village distribution one must either cross gardens or go in the road and (where there are curves) obstruct the view with numbers of poles for short spans to keep off the hedge line. Surely an owner is injured more by a line in full view of his best-room windows, having perhaps a pole on the footway adjoining his front gate, than by a line over his cabbages at the back. The best we can do now is to point this out to the owner and his neighbours, and carry the line along the highway if he will not grant a wayleave. Unfortunately one unreasonable owner now inflicts the "front of the house" line upon his neighbours for about a quarter of a mile, because we cannot zigzag from back to front for individual houses. The writer made inquiries as to the possibility of introducing a clause into the 1926 Bill to put this matter right, but was told that the Bill was not to help "distribution."

(To be continued.)

Domestic Water Heating.

The author claims that electricity at 1d. per kWh for water heating can be a commercial proposition, but offers a warning against supplying on special conditions when the load may have to be purchased in bulk on an over-all load-factor basis.

By JOHN H. PARKER, M.I.E.E.

DURING the discussion at the I.M.E.A. Convention on Mr. Berry's paper on "Electrical Homes," great emphasis was laid on the cost of domestic water heating, and on the necessity of making water heating a night load at a special cut price—something a little above the fuel cost. But heating water by electricity can be made prohibitive in price if electrical engineers allow jerry plumbers to dictate to them how hot water is to be supplied in a house.

No electrical engineer would dream of converting the average kitchen grate provided by the house builder from coal to electric heating—it is so obviously the wrong thing to do, and would involve so great a waste of the available heat—yet electrical men think nothing of merely adding an immersion heater or two to the ordinary domestic water tank, which usually cannot be properly lagged, and is generally connected to a lot of pipes which act as "condensers" of hot water.

The sensible way to provide hot water in an old house is to install properly-lagged water heaters, controlled by thermostats, at the sink and in the bathroom.

A 1½-gallon heater at the sink, with a 500-watt loading, gives all the hot water that is required; the thermostat should be set high, about 190 deg. F., so that the water is too hot for washing either hands or dishes under the tap; and the heater should be of tinned copper, so that the water is suitable for cooking, or filling the kettle. In such a small heater the water does not remain long stagnant, so it is quite suitable for all domestic purposes, and when the tank is emptied it will heat up again within the hour. Such a heater costs less than £6, and can be connected up very cheaply; it has a low demand, but takes current

for several hours of each day, so that it uses a fair amount of energy, and is the best proposition that a supply authority can hire out; it is also such a boon to the housewife that, once installed, it is in for always.

For baths an 11-gallon heater, which when full weighs about 1½ cwt., is all that the wall of a modern house will carry safely. I try to deter people from installing larger ones, for my experience is that with hot baths always available, the water is in constant use and the bill at the end of a quarter gives the consumer something of a shock; therefore, as in the case of the sink heater, I limit the size of the bath-water heater. If after a quarter's use they still want a larger size, then it is easy to change the heater, as the plumbing and wiring will do for either the 11-gallon or the 22-gallon size.

The proper loading for an 11-gallon heater is 1,000 watts. This enables children to have a bath, and four hours later the water is up to full heat for another bath. A "good" hot bath requires 4 units, and at a penny a unit it costs 4d.; heater manufacturers quote lower figures, but it is best to quote a figure which is well on the safe side and which cannot be disputed.

It is always a wise precaution to have a block of coal in the show-room cut into a cube (it looks smaller as a cube than any other shape); this block of fuel should be 4d.-worth, at the price of coal current in the town. If any housewife protests at paying 4d. for a hot bath, show her the cube of coal and ask her whether, if limited to that piece of coal, she could heat enough cold water for a bath, and she will invariably say "no." It is a simple matter to show her with a spring balance that that block of coal really costs 4d., but because she buys by the ton she doesn't realise how much her water heating really costs. This convincing demonstration of relative costs generally places a bath heater, but I prefer not to push the bath heater until the small sink heater has been in for a quarter and has made itself indispensable.

With bath heaters the question of hot water at the wash basin invariably arises, and can be very simply solved. The outlet of these heaters should always be open, to prevent rise in pressure; unscrew the outlet nozzle to the bath, and insert a tee piece and a tap between the water tank and the nozzle; from the tee piece a pipe is carried round to the hot tap of the wash basin, and the inside is taken from the wash-basin tap so that it cannot be closed. Normally the tap below the tee piece leading to the bath is closed, and when the cold water is turned on at the heater the hot water runs into the wash basin.

When a bath is required, the tap over the bath is opened and the siphoning effect of the water running into the bath prevents any water going into the basin. If there is any wall space between the bath and the wash basin, set the hot pipe a few inches out from the wall and put a towel rail over it; it looks well, and uses up whatever heat there is in the water pipe for towel drying.

The water at West Hartlepool is very hard (26 degrees of hardness), so I carefully experimented with the heaters for some months before hiring them out. During the last 12 months I have put out 92 heaters, and not only are they all in constant use, but in several cases, when I sent round at the end of nine months to fetch the small sink heaters in for cleaning, the ladies refused to let them go even for a day; so I make a practice now of sending out a heater to replace the one brought in—it is merely a matter of four screws and a screwed water connection. It is not really necessary to clean them so frequently, but I was taking no chances with my water and really wanted data. The sediment was soft and could be brushed off, but I believe that if it were allowed to accumulate and insulate the heater from the water, it might cause overheating and consequent scaling, so I have decided to clean out at the end of nine months. Bath heaters, which are not so frequently used, I propose to leave for longer periods.

In view of my experience during the last 12 months, I can confidently assert that even with electricity at 1d. a unit, water heating is a commercial proposition if a properly designed heater is used and obvious precautions are taken to prevent waste caused by lack of suitable lagging, or by using wasteful lengths of interconnecting piping or by providing water at so comfortable a temperature that it can be used at a running tap.

I am not suggesting that this method is the ultimate end to aim at; all I claim is that adequate supplies of hot water can be provided at the sink and reasonable bath requirements can be met in existing houses by two water heaters, which provide a very fine load factor and simplify enormously the work of a house, especially during the summer months.

When large quantities of hot water are required for lavish use, it would be necessary to supply it as a night load at very low charges; but before engineers begin to build up this type of load, they must consider very carefully how they are going to supply that load in a few years when they are taking a bulk supply.

A concrete case may illustrate my meaning. In West Hartlepool, which has a waste-heat supply station, there was built up in the past a very fine bulk-supply power load, with a selling price ranging down to just over ½d. per unit.

When the waste heat ceased two years ago, the small supplementary boilers used with the waste-heat supply could not provide enough steam to meet all demands, and more and more load had to be transferred to the bulk supply authority. The terms of supply were the usual maximum demand and running charge, which at low load factors was costly, but at high load factors worked out reasonably cheaply; the difficulty, however, lies in the fact that one cannot buy in bulk and cater for special conditions at the same time.

I have a bulk-supply consumer whose load factor is 66 per cent., but as my total load factor is only 30 per cent., I must buy all my energy (high pressure) at 0.66d., although if I could isolate that particular consumer I could, under the same contract, purchase his supplies at 0.44d.

The bulk supply authorities' running charge is 0.3d., so that they could sell night load at half the price they charge me and make a profit; but how can I sell cheap night-load energy when I have to pay 0.66d. for every high-pressure unit bought, including those used in conversion and distribution? Dare any of the three or four hundred engineers who are going to purchase in bulk during the next few years, at a price based on the over-all load factor of the station, invest money in water-heating equipment to build up a night load at something a little above fuel cost?

This is a problem that has to be faced very seriously. In the meantime one has to be content to get what business is possible round about one penny per unit (and water heating can be got at that price even in the Durham coal fields), and pray that the industrial contract loads at prices based on the low fuel cost of one's own station will not revive sufficiently to kill the profit on the other loads, because bulk supplies can only be bought on an over-all load-factor basis. What an inglorious ending to 25 years' electrical development!

I.E.E. Grant to B.E.S.A.

In view of the value of the work so far accomplished by the B.E.S.A., and the inadequacy of its financial resources, the Institution of Electrical Engineers has this year made a grant of £1,000 to the British Engineering Standards Association. The example is one that might well be followed not only by other engineering bodies, but also by manufacturers, electricity supply authorities, and others who profit by the work of the Association.

Hire-Purchase Selling.

The System considered from the Electrical Retailer's point of view.

By A. W. W.

THE sale of houses on an instalment basis has long been a feature of real estate business. Since the war, however, the instalment practice has been extended in the United States to almost every kind of luxury article, and the fashion is beginning to catch on in Great Britain. Especially is this so in the case of electrical domestic articles and electric installations. We are told that the system is merely the tally-man's business brought up to date, that although sound in principle it has certain weak points, and so on: but be its origin humble or high, its basis perfectly sound or otherwise, retail electrical tradesmen are finding it more and more difficult to dispose of their merchandise without its aid, and the need of a careful consideration of the system is apparent.

From a legal viewpoint a hire-purchase agreement is one whereby a person hires an article with the option of finally acquiring it permanently. In practice, however, it is more usually a method of spreading the purchase price of an article over an arranged period, the purchaser having the use of the article from the time of the first payment. Nevertheless, legally, the ownership of the article remains with the seller until the last payment has been made, and in consequence the greatest care must be taken in drawing up the agreement, especially in respect of risks run against third parties.

Of the fundamentals necessary to the successful and safe operation of a hire-purchase agreement, perhaps the most important is that the article sold should be a durable one that does not deteriorate rapidly in value. Obviously, purchasers would be very reluctant to continue payments on an article which no longer existed as of any value, and in the event of the agreement being terminated the seller would receive nothing to offset the balance outstanding on the account. It is also very important that the first payment or deposit should be sufficient to make the intending purchaser seriously ponder over the matter and to act as a deterrent against his frivolously entering into an agreement which he is not in a position to keep. Further, the deposit should be large enough to cover the initial depreciation of the commodity, so that at any time the selling value of the article is always in excess of the balance unpaid. In this connection it may be pointed out that the no-deposit schemes recently inaugurated by several of the big furnishing houses constitute a real menace. It is appreciated that in certain cases a tradesman may consider himself obliged to adopt a no-deposit or small-deposit scheme in order to secure business, but in such a case he should realise the risk he is running and adjust his price so as to enable him to set up a reserve to cover contingent losses.

Even with a suitable commodity and a sufficient initial deposit, however, the retailer should not enter into agreements indiscriminately with any Tom, Dick or Harry who strolls into his shop, in spite of the example apparently set by certain large concerns. Every proposed credit risk should be most carefully examined, and under no circumstances should a prospective purchaser be tempted to enter into an agreement for an article obviously beyond his means. Moreover, even if the purchaser's credit is sound his moral character should be studied as carefully as possible and the period of the agreement should be short enough to render improbable any violent change in his financial position. Another advantage from keeping the payment period as short as possible is that there is then less likelihood of any large decline in the selling price of the article over the period. A considerable fall in price before the agreement was concluded would naturally tend to create ill-feeling, whereas the goodwill of the customer should always be preserved at any reasonable cost.

Provided these precautions are taken, a dealer is undoubtedly justified in adopting such a system, but he should realise that the scheme has not yet been put to the fire-test of an acute and widespread business depression. Its probable behaviour under such a circumstance is therefore largely a matter of conjecture. On the one hand, it is argued that the shortage of work and resultant fall in wages would cause payments to cease in many cases with a consequently glutted second-hand market and a more extended period of depression than would otherwise have existed. On the other hand, it is claimed that the suspension of payments would not be so extensive as is suggested, and that the system would result in demand picking up sooner than if purchasers were obliged to acquire the whole capital cost of an article before buying. On the whole it seems that any future depression will be foreseen sufficiently far ahead to enable the volume of outstanding credits to be reduced to a safe level before the crash, and in any case the risk seems one that the trader is quite justified in taking, provided the necessary precautionary measures outlined in this article have been adopted.

From a social viewpoint it is asserted in certain quarters that the practice has a very harmful effect on public saving, and that it is demoralising. Quite an opposite view is supported by statistics for America, the home of the system, where, in spite of the large volume of hire-purchase buying, savings-bank deposits have shown a considerable increase instead of the predicted fall. Further, the hire-purchase agreement, where it is for a durable commodity reasonably permanent value, is in itself a method of saving and the portion of an individual's income that is spent in this way would probably have been squandered on luxuries had he not entered into the agreement. Where the system is indiscriminately extended to purely luxury articles, however, it is admittedly conducive to extravagance, and where a purchaser is heavily "oversold" it may result in his mortgaging his future income to such an extent that he gives up in despair the effort to meet his commitments or deprives himself of necessaries in order to make his payments.

Taking all factors into consideration the balance is undoubtedly in favour of a conservative application of the system to electrical retail selling. Although the lines of merchandise dealt in can hardly be considered indispensable they have an extremely useful and fairly long working life, and as labour-saving devices they undoubtedly exert an uplifting influence on the standard of living. Experience indicates, however, that it is unwise to accept an initial deposit of less than 10 per cent. or to extend the term of payments beyond a year, although in the case of refrigerators and washers the payments might fairly safely be spread over eighteen months.

It will probably be argued that if all the suggested precautions be taken the consequent increased cost of the article to the hire-purchaser will deter many from taking advantage of the scheme. This is in a measure undeniably true, but it is an essential feature if the system is not to end in disaster. In fact the whole safety of any hire-purchase arrangement lies in the proper appraisement of all credit factors, any abuse of which must inevitably bring its punishment.

Multi-Range A.C. Instruments.

A *résumé* of the various types of instruments suitable for a.c. measurement at power frequencies, and their applicability to various purposes.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

(*Continued from page* 297.)

PART II.

The Electrostatic Voltmeter.

(*a*) *Used as an Ammeter.*—At low frequencies the capacitance and inductance of this type are negligible, and no phase-angle error exists with the use of shunts, either non-inductive or inductive, or transformers. With non-inductive shunts, the calibration as an ammeter is dependent only on that of the voltmeter and the resistance of the shunt; it is, therefore, independent of frequency. Any number of shunts may be employed, one range per shunt being obtainable. With inductive shunts, the power loss is less, but the presence of the inductance may modify the circuit so as to be inadmissible in some cases. The current calibration is directly proportional to the frequency, which must therefore be known as accurately as it is desired to express the readings of current. Another method is the use of potential transformers, the primary being of low voltage and connected across a shunt in the main circuit. The secondary may have a p.d. of the order of 100 V, or any other voltage to suit a particular instrument. Means of increasing the range in this manner are the use of several shunts, the p.d. across each at full load being the same and equal to the primary voltage of the transformer. Another method is to use a number of transformers of different ratio, but this is not such a simple expedient as the former. Finally, a single variable-ratio transformer may be used, the variation being on the primary. If an inductive shunt or a transformer is used, the voltmeter cannot be calibrated as an ammeter with direct current, but with non-inductive shunts only this can be done. It should be noted that if a current transformer is calibrated with one or two instruments, constituting a relatively low-resistance burden or load, its use with an electrostatic voltmeter may not be correct, on account of the open circuit existing across the transformer secondary. For the most accurate work, a transformer of small dimensions is needed, as there will be no measurable current flow in the secondary, the total load being the losses.

(*b*) *Used as a Voltmeter.*—As this type of instrument consumes no steady current on d.c. and a negligible one at power and telephonic frequencies, any additional circuit for increasing the range which consumes current is detrimental, and not often permissible.

If the instrument is for use on d.c. or a.c., it is not possible to increase the number of ranges except by the employment of a potentiometer-resistance. This consumes power, but the resistance may be made as high as desired, provided the insulation resistance of the indicator is considerably greater. Where this is permissible the number of ranges is large, especially if a potentiometer-resistance of the type of the Thomson-Varley or the Rymer-Jones universal shunt is used. The total resistance must be sufficient to withstand the voltage of the highest range required, and the winding must be non-inductive, especially if telephonic frequencies are to be attained. Higher ranges only can be attained in this manner, the lowest being that of the indicator itself. For use on a.c. only, the negligible consumption of this type can still be retained. A potentiometer can be made with condensers; the ratios of these condensers will determine the increase of range, and if one set is adjustable, the number of ranges becomes legion. The fraction of the total capacitance shunting the instrument must be greater than that of the indicator, say, of the order of at least ten times. This is necessary, as the capacitance of the voltmeter varies with the angular position of the movement, so that unless its change of capacitance is small compared with its shunting capacitance, the multiplying factor will vary. Increasing range by the addition of series condensers is not correct, owing to the variation of capacitance of the indicator, although it is permissible to connect two similar instruments in series and to add their readings. High-pressure voltmeters of this class may be given a number of ranges by providing a device for varying the capacitance between the electrodes, at any position of the movement. The single-vane type can be made to have several ranges in this manner, but the mechanical refinement is very delicate, as the moving vane must always be central between the fixed inductors. The attracted-disk type is the most amenable to this treatment, and the Abraham extra-high-pressure voltmeter has several ranges provided in this manner [15]. Potential transformers provide another means of increasing range, and either several transformers with different primary and a common secondary voltage may be used, or one transformer with a variable ratio. It is, of course, only applicable to a.c., but it can be an increase or a decrease of range, unlike the previous methods which increase the range only.

Thermal Instruments.

Of the two types of thermal instrument, the methods of range-increasing are in general applicable to each. The great application of these instruments is to radio-frequency circuits and to a limited extent to low-frequency circuits of very bad wave-form, *i.e.*, having high harmonics. The lowest range is usually that of the indicator itself, which was stated in Part I, but lower ranges are possible with the aid of step-up transformers. This is usually undesirable on account of the already high consumption of these indicators, which on low ranges frequently alters the conditions of the circuit. The simplest method of increasing the range as an ammeter is by means of shunts [16]. At high frequencies these shunts must not be plain external shunts such as are used with moving-coil instruments, but must be so disposed that the ratio of current in the shunt and winding is constant at all frequencies. This usually necessitates a symmetrical arrangement of the conductors inside the instrument case, as is well known. Multi-range instruments with shunts are, therefore, not simple to produce, unless one definite frequency is to be worked with, when the shunts may be external and the resistance determined with regard to this frequency. If inductive shunts are employed, the shunts still require adjusting to some particular frequency, unless the instrument is so designed that the whole of the winding, *i.e.*, shunt and working wire, can be removed and changed as a unit. This is not a very practicable proposition. The range of an instrument may be increased to above the current taken by the wire by means of connections paralleling parts of the wire. This is not, however, a practicable method of producing a multi-range ammeter. Probably the best means of producing a multi-range instrument for radio frequencies is to use a number of transformers. Air-core transformers for this work have long been used, either with a wound primary or a primary consisting of one or more turns of the main conductor, as is often done for

[15] The numbered references are to a bibliography which is appended to the article.

low frequency. More lately iron-cored transformers have been used, and McLachlan [17] [18], Campbell and Dye [19] [20], and Moullin [21], amongst others, have done work on this subject. In these transformers the iron, either plain "Stalloy" or a nickel-iron alloy, is worked at a very low induction density, and the design of the windings must be such that the stray fields are reduced as low as possible and kept to well defined channels.

Iron-cored current transformers to measure radio-frequency currents up to 1,000 A are in use at the Rugby station of the G.P.O.[12]. With instruments of the thermo-e.m.f. type of relatively low maximum range, it is easier to produce several ranges. Instruments are marketed with several junctions which may be either in air or vacuo. With air junctions the whole of the junction, with its four terminals, is removable, so that a multi-range ammeter or milliammeter consists of an indicator and any number of independent junctions, either removable or self-contained and controlled by a switch. Ranges up to several or possibly even a hundred amperes could be attained by this means, but the lower limit is that of the smallest heater wire, with a given galvanometer or millivoltmeter. With vacuo-junctions the lowest and the highest ranges are lower than those of the air junction. The former is due to the higher sensitivity of the vacuo-junction, and the latter to the construction of the vacuo-junction, which is not made at present with heater wires for more than a few amperes, although with the experience of cooled-anode valves having filament lead-in wires for up to 125 A, it should be possible to develop junctions for ranges much higher than those obtaining at present. The overload capacity of this type is rather greater than that of the expansion type, which is practically nil. Radio-frequency transformers of either type are equally applicable to both types of thermal instrument. Thermal voltmeters do not appear to be in such demand as ammeters, but when used, the range can be increased by series resistances, which must be absolutely non-inductive, or by potential transformers analogous to those described for ammeters.

Moving-Iron Instruments.

As was previously stated, this class of instrument is generally the most suitable for switchboard and portable instruments when commercial accuracy only is desired. The means of increasing the range are probably more numerous than for any other type of a.c. instrument. The consumption of these instruments of either the attraction or the repulsion type varies from about 1 W in low-range good quality instruments to 10 W or more for high-range ones. Lower ranges than 10 V and 1 A respectively for full scale are not usual, but above these lower limits, any range is practicable. With ammeters, the simplest method of increasing the range is by means of a number of shunts. If these are non-inductive, similar to those for moving-coil instruments, the reading will not be directly proportional to the ratio of the resistances, as the ammeter coil necessarily is inductive, and as its resistance is low, its time constant L/R is high, so that although direct proportionality exists when used on d.c., on a.c., which is the scope of this type of instrument, non-inductive shunts are only correct at a given frequency[22], and their resistances cannot be determined directly from the resistance of the winding and the multiplying factor required.

For accuracy at all frequencies, the shunt should be inductive, and the time constant of the shunt should equal that of the winding. Inductive shunts are made by some firms by enclosing the shunt in a soft-iron tube. Again, referring to Edgcumbe and Ockenden's paper, the ammeter described has such a low consumption, due to the reduced ampere-turns required, that the inductance of the coil is also low, and, in fact, is practically equal to that of an ordinary straight shunt, which already has a low inductance. Shunting an instrument of this type with non-inductive shunts is quite correct and within the precision obtained by the ammeter alone. High-range shunts give the least error, and on low ranges a swamp is useful to reduce the effective inductance of the indicator. The consumption being low, it is obvious that the potential drop across such a shunt would be less than that across a shunt suitable for an ordinary ammeter of the moving-iron type. By making use of inductive shunts, a multi-range instrument may easily be constructed, either with external shunts or with self-contained ones brought into use either by terminals and links or some switching arrangement. For high ranges, the disadvantages of the high consumption is great, and other methods usually prevail. The pressure drop across a shunt for an a.c. ammeter is generally of the order of .7 to 1.0 V, which is ten times greater than that across a shunt for a moving-coil ammeter. Occasionally extra ranges are introduced by tappings on the working coil. This is not satisfactory for more than two total ranges, as on the highest range a smaller number of turns is in use, and the heating will consequently be greater. The lowest range corresponds to the full winding, which should be graded to suit the different ranges.

For two ranges only, this method is successfully used, and is fairly simple and cheap. It is most suitable for a factor of about two. Another method is the use of two or possibly three distinct windings on the bobbin. Each has the same ampere-turns, and the wires or strip conductors are graded according to the full scale currents. It has the advantage that each range is entirely independent of the others, so that any ranges whatever may be used, and limited usually only by the fact of requiring a common scale for each range, *i.e.*, a multiple of 2, 5 or 10. Its disadvantage is that only one half the total winding on the bobbin is in use on any one range, for a two-range instrument, or one third for a triple-range. For portable instruments intended for temporary use, this is not an insuperable barrier to its use, but again it is not usually as efficient as later methods. Perhaps the commonest method of producing a multi-range instrument of either the switchboard or portable type is to employ current transformers. This is so general that an indicator for use in this manner is standardised by the B.E.S.A. [23] for 5 amperes at full scale. Any number of transformers may be used, and quite often single-range instruments are produced in this way, so as to avoid heavy current leads at the instrument. Its use in e.h.p. circuits is well known, and needs no discussion here. A modification is to use a single transformer of multi-range, obtained either by tappings on the transformer or a series-parallel arrangement of the primary winding. A common means of producing a variable ratio transformer is to have no wound primary, but a space through the core where the primary conductor may be passed, any number of times. This is a very satisfactory manner of accomplishing the purpose, but above about ten or twelve turns winding the conductor becomes tedious. The range is thus from about 20-30 A, with maximum turns to about 200-400 with a straight-through conductor. It is immaterial if the remainder of the conductor passes near to the transformer or not, the rule as to number of turns being the number of times a free end of conductor is passed through the aperture in the same direction. Some transformers of this type also incorporate a winding for ranges lower than about 20 A. Much investigation of current (and potential) transformers has taken place lately, and numerous results are published [23] [24] [25] [26] [27] [28] [29]. The ranges obtainable may be in any sequence, and are generally only limited by the desirability of the provision of a common scale factor. The volt-ampere consumption of an instrument with a transformer is necessarily greater than with a self-contained winding. Ratings for current transformers are specified by B.E.S.A. at 15 or 40 volt-amperes. These are capable of operating two or three ammeters in series if necessary, and the larger one is suitable for operating relays and integrating instruments as well as an ammeter and wattmeter.

(To be concluded.)

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The New Rating Provisions for Business Premises.

The Position of Machinery and Plant.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE provisions of the Rating and Valuation Act, 1925, which came into force on April 1st this year, materially affect the mode of assessing business premises for the purpose of rates. Whether the alterations in the law will result in higher assessments remains to be seen from the spirit in which the official valuers carry out the new provisions. In the main little difference should occur between assessments under the new law and those under the old, and in some cases the occupier of premises may gain an advantage.

Under the old law, buildings containing machinery or plant were first of all given a "gross value." This value was based on an estimate of the gross rent which might reasonably be asked by a landlord who did all repairs. To obtain the "net annual value" or "ratable value" on which assessments for rates were to be made, a deduction was made from the gross value. This deduction represented the annual cost of repairs, insurance, and other necessary outgoings incurred by the landlord, so that the landlord paid rates upon the net income received from the property. The rates, of course, were paid by the tenant, and this was a factor in determining the rent as between landlord and tenant, but it did not affect the mode of assessment.

Where the machinery and plant on the premises were of such a nature that they increased the letting value, the gross value of the premises included a valuation for the machinery and plant. This was ascertained by estimating what their rental value would be if the tenant hired them from a landlord who provided them at his own expense. The usual way of arriving at this was to estimate the capital value of the plant and then apply a percentage to such value, this percentage being based on the life of the machinery and taking into account its upkeep and repair.

The new Act abolishes all this. Gross values are done away with, and some classes of plant are left out of account entirely in the valuation. In ordinary industrial businesses the ratable value is the rent which the premises would be expected to fetch if the tenant paid rates, taxes, insurance and repairs. In the case of electrical undertakings for the supply of power on a public utility scale, the ratable value is estimated from the profits. These undertakings will be mentioned later on in this article, so for the moment let them be left aside.

An ordinary manufactory or business with machinery is to be valued by reference to its net rent. In estimating this rent, the machinery and plant are to be left out of account unless they fall within Schedule 3 of the Act. At first sight this looks like an advantage to the occupier. Desks in a school, seats in a kinema, counters in a bank are no longer to be valued for rating purposes. But machinery within Schedule 3 is to be considered as part of the premises, and will be valued with the premises when the rent is estimated.

For premises containing scheduled machinery, then, the Act makes little difference except as regards the gross value. Instead of estimating a gross value from a gross rent, then deducting the estimated cost of repairs and outgoings, the Act goes straight to net rent as the basis of valuation, and includes scheduled machinery in the valuation. The scheduled machinery will be valued as before on a percentage of its capital value. This percentage is estimated as an answer to the question: What would a landlord who provided such machinery expect as a net annual return for it sufficient to provide an interest on his investment after reimbursing his capital?

Non-scheduled machinery is no longer valued, but the list of scheduled plant is so long that in the case of an electrical manufacturer it will only be machinery which is distinctly for manufacturing purposes and not for power, which is exempt from valuation.

In the case of undertakings whose ratable value was formerly based on receipts and profits, no alteration is made in the law. Their gross value will be estimated as before and machinery *of all kinds* valued by reference to capital value. There is no plant which is exempt in the case of such undertakings. Roughly speaking, exempted machinery will be that which is used for making or treating articles of manufacture. Lathes, presses, drills, forges, melting and casting apparatus, as well as office plant will be exempt from valuation. But plant used for generating power, lifts and elevators, railway lines, and buildings will be valued, because they are specified in the third Schedule to the Act.

In order to ascertain exactly what articles come within the schedule, the Plant and Machinery Order, 1927, should be consulted. The Act itself provides that in cases of doubt, occupiers may inquire from the rating authority what machinery and plant fall within the schedule.

The schedule divides ratable machinery and plant into five classes, as follows: (1) Appliances and structures used in connection with "generation, storage, primary transformation or main transmission of power on the premises." Any plant used for changing the pressure or frequency or form of the current (whether the current is supplied to the premises or made on the premises) is within the schedule, provided that the transformation is effected at some point in the main transmission.

"Main transmission" means the transmission from the meter or dynamo on the premises to the point at which the power either passes from the premises to other premises, or to the main distribution board. In the latter case the intervention of a transformer between generating plant and distributing board makes no difference to the definition. The bus-bars of the main board must carry energy at the pressure at which the power distribution circuits are supplied; otherwise the board is not counted as a main distribution board.

In the case of power transmitted by shafts or gears, "main transmission" means and includes any shaft or gear directly driven by belts, gears or other means from the main shaft or gear. In the case of hydraulic or pneumatic power, "main transmission" means the piping and other fittings from the point of supply to the point where the main pipe ceases. All these are ratable, and are more clearly specified in the Schedule to Class 1 (*a*) of the Order.

(2) Plant used for heating, cooling, ventilating, light-

ing, supplying water or draining, or for protecting the premises from fire. But the mere fact that plant used in manufacture also serves for any of the purposes above mentioned does not bring it within the Act. Such articles as fans, sprinkler systems and gas radiators become ratable and are, with other articles, specified in the Schedule to Class 1 (*b*) of the Order.

(3) Plant used for storing or handling fuel for generating power, such as cranes, pulverisers, and gasholders are therefore ratable.

Accessories of plant within Classes 1 and 2 above are ratable, such as foundations, pipes, filters, instruments and bearings for shafting.

(4) Lifts and elevators for passengers; (5) railway lines and trucks; and (6) any part of any machinery or plant where such part is of the nature of a building, for example, chimneys, bins and hoppers, ovens, pits for inspection or cooling, retorts, tanks and wireless masts. A full list is set out in Class 4 of the Order.

All other machinery and plant is exempt from valuation, and must be ignored in making an assessment for rates.

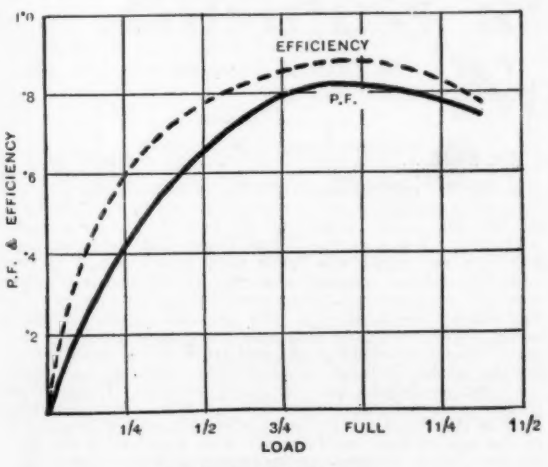
The Electric Drive.

Some considerations on the choice between group and individual driving by means of induction motors.

By A. G. POWELL.

THE trend of present practice is decidedly towards the individual driving of machines by built-in motors. Whilst this is ideal from the points of view of simplicity and economy in floor space, compared with gear or belt driving, it is to be regretted that in many cases the individual drive has been adopted in many large installations without due regard to the claims of group driving. It seems to be the prevalent idea that the electric motor lends itself so well to individual driving of machines that any resort to group driving is a reversion to the days when machines were driven by steam engines through miles of shafting and belts. Whilst the individual drive is essentially electric, the converse is not the case, and to obtain the best results due regard must be given to the claims of both methods when planning-out any installation.

The squirrel-cage induction motor is without doubt the most frequently employed type of motor for general industrial drives, for the lower horse-powers at any



Induction-Motor Test Curves.

rate, and some consideration of its characteristics, with particular attention to power factor and efficiency, may be advantageous.

The greatest disadvantage of this type of motor is its low efficiency and power factor when running lightly loaded. In planning an installation the tendency is, of course, to allow an ample margin between the horse-power of the motor installed, and that reputed to be required. There is some justification for this; machine makers certainly do not over-rate the power required by their machines, and for his own peace of mind the engineer does not want the motors under his care to be overloaded. The general result of an installation consisting of a large number of small machines, individually driven by induction motors, is that the efficiency and power factor are very low, and that there is a needless investment of money in the larger motors.

Typical curves for a 3-h.p., 3-phase, 960-r.p.m., squirrel-cage induction motor are given herewith.

The effect of over-motoring can be clearly seen. To quote a case in point, tests in a certain large works proved the motors to be running under an average load equal to 30 per cent. of their rated capacity, the mean power factor being 60 per cent. and the average motor efficiency 79 per cent. By increasing the loading to 75 per cent. of the rated capacity, the power factor might be brought up to 80 per cent., or even higher, and the efficiency up to 85 or 90 per cent.

The consideration of group or individual drive is of primary importance; at the most a motor should drive only a comparatively small group of machines. Peak loads on the individual machines obviously constitute a lower proportion of the motor horse-power with group than with individual driving, and may be entirely compensated for by coincident low demands from other machines in the group. On the other hand, if a fairly constant average load is not obtainable from a group of machines, these had better not be driven by a single motor, otherwise a low average efficiency and power factor will result.

With large machines, group driving is, of course, frequently impossible owing to the size of the motor which would be required. A very useful scheme where fairly large powers are concerned and group driving is desirable in spite of the fact that the average load of the group is far from constant, is to employ two motors, the size of each being one-half the total horse-power required. These motors are both connected through centrifugal clutches to a reduction gear from which the line-shaft is belt or chain driven. For loads up to half the total load, only one motor is run, the other being started up as and when required. This scheme has been particularly useful in chemical works, where it has been impossible to adopt individual drives owing to the corrosive atmosphere.

With regard to first costs, the balance is usually in favour of the group method of driving, as the cost of the motor does not increase in anywhere near direct proportion to its horse-power, and the difference in price between one large motor and a number of small ones usually more than pays for the expenditure on shafting, &c., without taking into account the additional cost of wiring a number of small motors.

Legal.

False Pretences Charge.

At Old Street on August 19th, F. T. Williams, 21, radio dealer, Sutton, Surrey, was charged on remand with obtaining by false pretences, on April 13th, from Rène Rich, a quantity of radio accessories, value £52 9s. 6d., the property of Abraham Rich, Norton Folgate; on April 22nd and 23rd, from Charles Gerrett, radio accessories, value £47 18s. 11d., the property of the General Electric Co., Ltd.; on April 22nd, from Maurice Taylor, radio accessories, value £21 5s. 7d., the property of S.T., Ltd.; and on July 23rd, from Edward Marriott, three loud speakers, value £12 9s. 3d., the property of the Celestion Co., Ltd. Mr. Yale, who defended, said that his client had decided to withdraw his plea of "Not guilty" and to enter one of "Guilty." He asked his Worship to take into consideration all the charges and items upon which charges might be preferred.

Mr. Barker, who appeared for the prosecution, said that from February until July, the defendant went to various radio manufacturers and dealers and obtained goods to a large extent by stating that he was in a big way of business at Brixton Hill. He gave in payment cheques, which were returned by the bank. In addition to the amounts mentioned in the charges defendant admitted having goods which brought the total to about £350.

Detective Janes said defendant was bound over in May of last year. They did not regard him as the actual instigator, and witness did not even think that he had had the lion's share of the proceeds. None of the goods had been recovered.

Mr. Sharpe said that the defendant had submitted to the will and direction of other people, but he was of sufficient age to know that he was doing wrong. Defendant would go to prison for three months in the second division.

Alleged Result of Municipal Trading.

When George Phillips was charged at the Guildhall recently with the theft of a bicycle, it was stated that he was an electrical engineer but was unable to compete with the local borough council, which had commenced to undertake installation work. He had put in a tender of £13 10s. for some work but the Council had secured the contract with a quotation of £10. Phillips was remanded.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Rural Electric Lines.

Replying to Mr. Turnbull's letter in your issue of August 12th, I am sorry that, as a company engineer, I am not a member of the I.M.E.A. This, by the way, raises the point whether technical papers should be read before that Association, except when they have a very special bearing on municipal work as distinct from company work; I rather think we need an Electricity Supply Association comprising both municipal and company representation—councillors, directors, and engineers—to represent this industry, just as the Whitley Council represents it on matters relating to wages and salaries. Practical and technical papers, unsuitable perhaps for the I.E.E., would then get a proper discussion at the hands of those qualified to deal with them. This might be brought about by an amalgamation of the I.M.E.A., the Provincial Electrical Supply Committee, and the Power Companies' Association.

I cannot quite understand Mr. Turnbull's reasoning. He states that it is against the letter and spirit of the regulations for the Commissioners to accept a 19.26-ft. clearance calculated under blizzard conditions, whereas he states that his own lines give less than this, yet they are approved by the Commissioners.

With regard to the galvanised steel, I have no prejudices, and have, in fact, been trying to find a case where it was cheaper than copper. There are cases, no doubt, such as that which Mr. Turnbull mentions, where a 300-kW line only carries 25 kW, and the drop is negligible, but one will not obtain an income of £32 per annum per kW of maximum demand in rural work! I think my criticism to a great extent would have been avoided had Mr. Turnbull enlarged on the subject a little more.

I am not at all certain that wires left loose in "soft" insulators will be satisfactory over a long period, or that service tappings can be relied upon to anchor the line. However, experience is what we need, and even if a steel line and the Aylesbury pole do not fulfil all expectations, it is satisfactory to find men like Mr. Turnbull who are prepared to depart from the common rut.

Mr. R. Borlase Matthews's letter in your issue of the 19th inst. to some extent answers Mr. Turnbull on the subject of regulations. It has, for some time, been part of my case that detailed regulations are not needed by properly trained engineers. It would be just as sensible or senseless to specify details of underground cable laying, *e.g.*, to require sections and plans showing the exact route and depth and methods of getting round obstructions on each job, as it is to require details of overhead work. All that is necessary is to specify the factor of safety and leave the responsibility for the rest to be taken by the overhead engineer, as it always has been taken by the underground engineer. We were just as inexperienced 20 years ago in cable laying as we are to-day in overhead work, and I venture to say that, if we had been hampered in underground work as we are now in overhead work, progress would have been very slow in our town supplies. I expect there have been more horses killed by the earth being made alive in towns, due to defective cables and tramway standards, than there have been cows killed in the country by reason of fallen wires.

One is tempted to ask why overhead tramway wires are allowed to hang over our city streets at a pressure dangerous to life without tramway cars being provided with an earthed cradle guard of the Post Office pattern! The answer is that the engineers will have to face a coroner's inquest if anyone is killed, and take very good care that the lines are put up as safely as possible, having regard to the circumstances, and that, having the responsibility, they rise to the occasion as good citizens.

Why the same engineer, carrying out overhead work, should be the non-competent person that the Regulations assume, is beyond my comprehension, and I may say it is an insult which should be resented by every power-station engineer.

I agree with Mr. Matthews that it is time that those engineers dealing with overhead work combined to secure for themselves freedom from regulations made by those who know little or nothing of the requirements and conditions which have to be met, and to see that such regulations as are made do not specify cast-iron limits to apply to conditions which the drafters of the regulations had not thought of when the regulations were made.

I will conclude by quoting an early experience of mine just after the Board of Trade handed over to the Electricity Commissioners. At that time the Board of Trade regulations had been revised for high-pressure lines, and a minimum height of 20 ft. was specified. The low-pressure regulations remained unchanged at 22 ft. I had pointed this out to the Electrical Inspector of the Board of Trade, who saw the point and allowed me to proceed with low-pressure lines with 20 ft. clearance, knowing full well that it was only the absence of revision which had left the low-pressure line limit 2 ft. higher than the high-pressure line limit.

A few months afterwards I put forward a low-pressure line at the height of 20 ft. to the Commissioners, and explained what the Board of Trade had done, but was informed in a letter from the Secretary that the 22-ft. limit would be insisted upon until new regulations were put into force! I do not think for one moment that this letter came from a Commissioner, but it is a good example of what may happen when detailed regulations are drafted and are administered by officials.

W. Fennell,

General Manager and Engineer,
Mid-Cheshire Electricity Supply Co., Ltd.

Northwich, *August 22nd*, 1927.

Electro-Farming in Denmark.

As I have visited Denmark several times for the purpose of studying the applications of electricity to agriculture, I was very interested in the article which appeared in the Electrical Review for August 19th from the pen of Mr. V. Faaborg-Andersen. I was at the World Power Conference at Basle last year, and heard him speak then, as mentioned in your editorial. He has certainly given a very fair and comprehensive review of electro-farming conditions in his country. The map, in particular, gives a very good idea of the extent to which the high-pressure distribution system is developed—and many other Continental countries have a similar development. On the whole, England can show richer farming land, hence the great possibilities here can be appreciated. I hope to see similar co-operation, as regards the construction of overhead lines in this country, but have not much hope for co-operation in the sale of farm products, for with markets at the door, the temptation to break away, to get the higher prices occasionally offered, is too great. By the way, there is very effective co-operation in the construction of farm lines, between farmers and the South Wales Electrical Power Distribution Company.

As regards the comments on milking machines, the author rather stresses the fact that it is not possible to milk the udder dry. This is true with most machines, but if they are properly adjusted, the quantity left is negligible. As a matter of fact, there is one Danish milking machine—the only one I know of—that will milk the udder dry. The milking-machine electric-motor load, from its incidence in the early morning, before the factories start work, and then again in the early afternoon, before lights are switched on, is very valuable to a central electricity supply undertaking. Hence it is of importance to clear up any prejudice against milking

machines. From practical experience, I thought they were over-rated at one time, but later I found that the difficulty was merely that, as is the case with any mechanism, a man has to be taught to use a milking machine—it cannot simply be placed on a cow without knowledge as to how to do it or how to adjust the machine. There are some thousands of milking machines in Denmark, I understand. With every electro-mechanical aid in the cow byres, the work of cleaning, feeding, and milking 150 cows can be accomplished by three men, as against the fifteen normally needed. However low the wage may be, obviously it will cost less by the aid of electricity.

R. Borlase Matthews,
Wh.Ex., A.M.I.C.E., M.I.E.E., F.R.Ae.S.

East Grinstead, *August 20th*, 1927.

Much Ado—.

Can any of your readers beat this?

A lady overlooker in a department of a large manufacturing firm, rushed into the electrical shop in a state of great agitation and complained to the chief electrical engineer that "electricity was escaping" and that a whole row of machines in her department were "alive"; one girl had received a tremendous shock (in fact, lost the use of her left arm, &c.).

The C.E.E. sent his best man and labourer to investigate, and owing to the apparent extreme urgency, followed them.

On arrising at the scene of the "shock," they were all greatly worried as to its cause, and looked into all likely (and unlikely places), but failed to locate it; incidentally, it was noticed that the machines were *not* "alive" as alleged.

In sheer desperation the C.E.E. visited the girl (who was having attention) and asked her how she got the "shock"; her explanation was "that when using a small hand-brush to remove powder from the machine, she caught her elbow against the plate-glass case."

No further inquiries were necessary; the girl had obviously knocked the "funny-bone" of her arm, causing almost the same sensation as an electric shock.

John Soar.

Dartford, *August 20th*, 1927.

Earthing Systems.

We are glad to note the helpful suggestions of "T. J. B." on the somewhat neglected subject of earthing systems.

It cannot be too strongly emphasised that on power earths, where a heavy rush of current may take place from time to time, periodical testing is essential to ensure proper working of the devices.

We should like to supplement the description of the Paragon cone by stating that the cone is partially filled with powdered charcoal, which in itself retains moisture, and in conjunction with the surrounding broken coke will preserve a damp earth under extremely dry conditions. It is this special feature which has led to the adoption of the cone in many of the dry areas of the Colonies.

Paragon Electrical Company.

London, *August 22nd*, 1927.

Induction v. Moving Iron Instruments.

I notice in your current issue an article entitled "Multi-Range A.C. Instruments," by Mr. E. H. W. Banner. I feel I must call attention to a statement made in reference to induction instruments. Early in the article he refers to them as second-grade, and later, under the heading of "Induction Instruments," he states that as this type is generally inferior to the moving-iron type, some instrument makers will not make or recommend it.

I should like to state that my company has for a considerable time constructed induction instruments that are well within first-grade B.E.S.A. specification, and, further, that instead of the volt-ampere consumption for ammeters being 12 and for voltmeters 15, the actual consumption in the case of our ammeters is about 5 and voltmeters 2.5 to 3 VA.

I think it desirable to bring these facts to the notice of your readers, as it would appear that as far as induction instruments are concerned, at any rate, Mr. Banner does not seem conversant with the latest developments.

A. F. Harris,
Director, Nalder Bros. & Thompson, Ltd.

London, *August 19th*, 1927.

A "Telegraphic Journal" of 1864.

Referring to your sub-leader of August 19th, by a curious coincidence a fortnightly paper entitled "The Telephone" was published on January 1st, 1889, and also ran for one year. The opening editorial remarks may be of interest:—

"It is difficult to realise the fact that 10 years ago little or nothing was known of the telephone. In July, 1877, Mr. Preece brought the first pair of practical telephones to Europe. There are now more than 200,000 in daily use. We have now arrived in telephony at a stage similar to the one that telegraphy had reached thirty years ago, for it is no longer merely a question of sending telegraphic messages within the narrow limits of a town," &c.

L. E. Wilson.

Manchester, *August 22nd*, 1927.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A. Circle Campaign.

The first public function in connection with the 1927-28 Circle Campaign organised by the British Electrical Development Association is to be held in London on October 3rd. This takes the form of a luncheon at the Hotel Cecil, arranged by the London and Home Counties Area Committee. Similar luncheons are to be held on the same day in all parts of the country, and an excellent send-off should thus be given to the Campaign. Tickets for the London luncheon can be obtained from Mr. J. W. Beauchamp.

New Municipal Showroom.

The Radcliffe Urban District Council has received sanction to a loan of £1,380 for the provision of an electricity showroom, and has appointed Mr. W. Trinfield, of Wolverhampton, as showroom salesman.

The Electrical Accessories Manufacturers' Association.

This Association, in order to become more representative of the manufacturers of British electrical accessories, has decided to widen its scope, revising and simplifying its rules. It is looked to for the expression of the views of accessory manufacturers by such bodies as the B.E.S.A., and is represented upon the Statutory Committee set up by the Electricity Commissioners, and it now aims at closer co-operation with other representative electrical and trade associations, &c. The bodies particularly in view are the B.E.S.A., the B.I.F. authorities, the Board of Trade, the E.C.A., E.D.A., the Electricity Commission, the E.R.A., the E.W.F., the F.B.I. (of which the Association is a member), the P.E.F.A., &c. Membership is confined to British manufacturers of ceiling roses and cut-outs, conduits and fittings, fuse boards, ironclad switches, and fuses up to 15 A at 250 V, lampholders, tumbler switches, wall plugs and adaptors, fans, and other accessories (excluding cooking, heating, and motors).

Battery Separators.

In announcing their appointment as British agents for the Western Lumber Company, San Francisco, a very large manufacturer of battery separators, Messrs. Frederick J. Gordon and Co., Ltd., 92, Charlotte Street, W.1, send us samples of their principals' products. The separators are supplied in Port Orford cedar, either rotary cut, which means cut with a knife (this is the type of separator most generally used), shaved, or sawn.

Industrial Court Decisions.

The Industrial Court, dealing with a reference by the trade union side of District Joint Industrial Council No. 11 for the Electricity Supply Industry (South Coast Area), has fixed a scale of travelling expenses to be paid to men starting or stopping work away from their usual centre, and a meal allowance for men working away from the usual place. (Award No. 1,319.) Upon references by the Electrical Trades

Union, the National Union of Railwaymen and the Railways Staff Conference, the Court has decided that the railway companies are not entitled to place off duty on Christmas Day and/or Good Friday, without payment, shift workers employed in railway generating stations and sub-stations, and that the men concerned are entitled to payment at ordinary rates on the days in question. (Awards Nos. 1,329 and 1,330.)

New Zealand Electrical Imports.

According to the *Board of Trade Journal*, New Zealand imported electrical machinery and appliances to the value of £697,710 during the first quarter of this year. The item was the second largest in the import list (apparel being first) and was shared by the following:—United Kingdom, £403,629; Canada, £49,643; Australia, £7,034; and the United States, £174,083.

Recent Contracts.

The ENGLISH ELECTRIC CO., LTD., has secured an order from the Tobu Railway Company for motor coach and trailer coach equipments for the branch line from Sugito on the Asakusa-Kuzuu line to Nikko, which is being electrified, involving approximately 50 miles of rail. This order, obtained in the face of strong international competition, is the fourth placed by the Tobu Company with the English Electric Co., and includes the following: 28 motor-coach equipments, each comprising four 150-h.p. motors, the l.p. control gear being actuated and the lighting supplied by means of 2-kW motor-generator sets; 16 trailer coach control equipments for operation with the above. A normal train unit consists of one motor coach and one trailer, a train being made up of one or more units. Alternatively, a unit can also consist of two motor coaches and one trailer. Current collection is by means of two air-operated pantographs, which are arranged for electro-pneumatic control. The company has also secured the contract for two completely automatic rotary-convertor sub-stations to give a supply for this service at 1,500 V d.c. The h.p. supply is 3,300 V, 3-phase, 50 cycles, and in each sub-station this supply is controlled by means of two oil switch equipments, each having a rupturing capacity of 50,000 kVA. The sub-stations will each be equipped with two 500-kW, 1,500 V rotary convertors of the single commutator type. The transformers will be of the "English Electric" indoor type, and will step down from 3,300 volts to the requisite value for the input to the rotaries. The automatic control arrangements employ the "English Electric" camshaft controller principle, as used by the company for a considerable number of years on heavy locomotive service. The orders have a total value of approximately £60,000.

Messrs. JOHNSON & PHILLIPS, LTD., have recently received an order from the Egyptian Government for over 10,000 metres of telephone cable, including several lengths of 1,000-pair cable, of a total value of £12,500. The cable is for extensions at Medina Exchange.

A contract has been placed with Messrs. WORTHINGTON-SIMPSON, LTD., by the New South Wales Government for the whole of the power plant and pumping machinery required for the new Walsh Island floating dock. The plant consists of three Worthington-Simpson 360-h.p. solid injection oil engines, each coupled to a 230-kW generator, together with the necessary centrifugal pumping plant, motors and switchgear.

The British Industries Fair.

The management of the Heavy Section of the British Industries Fair reports that the space definitely booked for the 1928 display in Birmingham is some 5,400 square feet in excess of the total space occupied by the entire exhibition in that city last February. This position, attained a full six months before the opening, constitutes a new record in the history of the Fair. It is the more remarkable in view of the great extensions, totalling 120,000 square feet, at a cost of £30,000, which were carried out for the 1927 Fair, when, notwithstanding this increase of area, every available foot was occupied. The Birmingham authorities note with special satisfaction that 98 per cent. of the exhibitors of last February have again booked their positions, no fewer than 178 firms having applied for larger space, chiefly for the purpose of additional working exhibits.

The Electrification of Japan.

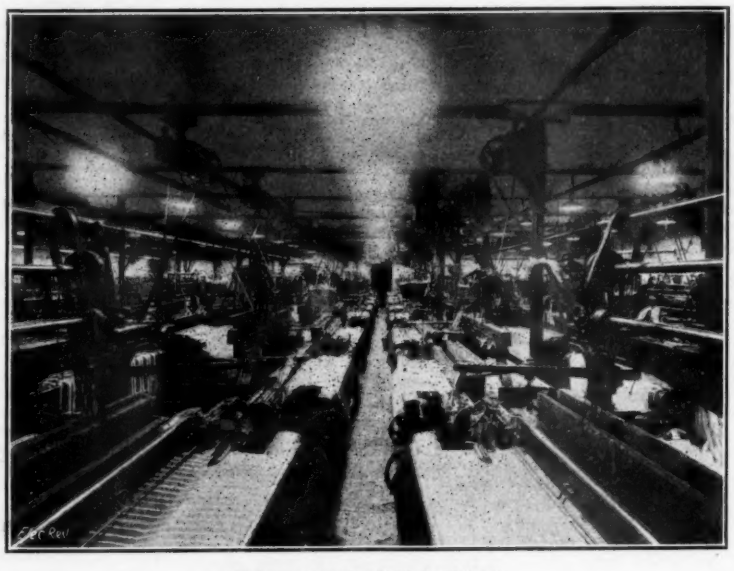
In a recent article upon the Japanese electrical industry, the *Journée Industrielle* (Paris) states that the present capacity of generating plant in Japan is over 3½ million kW, two-thirds of which is hydro-electric. To show the rapidity of the electrification of industry, our contemporary says that in 1915 55,000 motors, totalling 480,000 h.p., were in use; to-day there are 250,000, with a total capacity of 1,850,000 h.p.

Austrian Tariff Reductions.

Reciprocal reductions to those mentioned in our last issue, under the Austro-Czecho-Slovakian commercial treaty, are to be applied to Czecho-Slovakian goods imported into Austria. The concessions apply equally to United Kingdom goods, and include the following classes:—Steam boilers; resistance coils of grey cast iron; "gummon," with metal parts pressed in; and shaped parts of porcelain for electrical purposes, not equipped.

Better Mill Lighting.

The accompanying illustration shows the night effect of a new illumination system installed at Birks Mill, Walsden, near Todmorden, for Messrs. John Cockcroft & Sons, Ltd. The new extension to the mill was treated first, the installation comprising 25 "R.L.M." reflectors with 200-W "Cosmos" gasfilled bowl-sprayed lamps, mounted at a height of 10 ft. above the floor on 11-ft. centres, producing an average illumination of 8 foot-candles on the work. This installation gave such successful results, in terms of better working conditions, increased output, &c., that the owners decided to modernise the lighting of the old section. The old lighting was by means



Modern Textile-Mill Lighting.

of 60-W vacuum lamps in conical enamelled iron shades mounted at 6 ft. above the floor on 9-ft. centres, producing an average illumination of 1½ foot-candles. Glare from lamps in the line of vision was prevalent, and the dark surroundings were depressing to the workers. The illustration shows the new installation, comprising 67 "R.L.M." reflectors with 100-W "Cosmos" gasfilled bowl-sprayed lamps mounted at 9 ft. above the floor on 9-ft. centres, producing an average illumination of 6 foot-candles on the work. This intensity is quite sufficient in the old section as the materials woven are of a very light colour. The results are pleasing, giving a uniform illumination with absence of glare. In the Inspection Room there is a special installation producing an illumination of 10 foot-candles of approximate daylight colour. The installation was carried out by Messrs. Fred Rothwell, Ltd., Rochdale, to the designs of Metro-Vick Supplies, Ltd.

Patents in China.

Pending the promulgation of the new Chinese Patent Law, the Ministry of Agriculture and Commerce has decided that inventions which have already been patented in other countries may be registered in China upon the payment of a registration fee of $10 and an application fee of $2, which will be returned if the application is not granted.

Indian Electrical Imports.

Our Indian Correspondent reports that during the first quarter (April-June) of the current fiscal year, the imports of electrical machinery into India showed a decline, amounting to 50 lakhs in value, as against 59 lakhs in the corresponding period of last year. There was a considerable decrease in control and switchgear, transformers, and turbo-generating sets, whereas generators and motors showed some improvement. The decline in the trade was shared by all countries of supply, the imports from the United Kingdom falling in value from 45 lakhs to 41 lakhs. On the other hand the imports of electrical goods and apparatus improved from 65 lakhs to 70 lakhs. Electric fans rose from 10 to 12 lakhs, wires and cables from 20 to 22 lakhs, and the unenumerated class from 7 to 13 lakhs. The whole of the increase in imports was credited to the United Kingdom, whose share amounted to 44¼ lakhs, as against 38¾ in April-June, 1926, while imports from other countries remained stationary. The imports of wireless appara-

tus showed improvement and amounted to Rs. 271,000 in value, as against Rs. 117,000. This improvement must continue now that broadcasting has been commenced in earnest. Almost the whole of these goods came from the United Kingdom.

Catalogues and Lists.

MESSRS. HOPKINSONS, LTD., Britannia Works, Huddersfield. —List No. 2,040, containing illustrated notes on the company's "all-metal" draught gauges and accessories.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Price Lists No. 171/3, containing illustrated particulars of ironclad distribution panels for power service, and No. 241/4, dealing with oil-immersed rotor starters for mining and industrial service.

The BRITANNIA MANUFACTURING CO., LTD., 22-26, Britannia Street, N.1.—A comprehensive list of electric motors for sale or hire. The company also has a large repairing plant for motors and generators.

The HENDON ELECTRIC LAMP CO., LTD., 104, Southampton Row, W.C.1.—Four illustrated and priced leaflets dealing, respectively with the "Cecil" combined radiator and small cooker (with special utensils), an electric iron, a two-way adaptor, and heating plugs. Each pamphlet has a space for overprinting.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A well-produced booklet containing illustrated descriptions of "Universal" electric cookers, including patterns with automatic heat control.

THE GREGSON MFG. CO., LTD., 31, Tenby Street, Birmingham.—A priced and illustrated pamphlet advertising wood electric light fittings.

MESSRS. CRAWFORD & CO., Derby Road, West Green, N.15. —An illustrated booklet dealing with wireless jacks and their applications. Also a leaflet advertising the company's l.t. fuse terminal. Both lists are priced.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—An illustrated pocket catalogue covering cables, the "Prescot" wiring system, colliery lighting, feeder pillars, fuse boxes, joint boxes, meters, welders, transmission line material, &c.

MESSRS. A. W. BEUTTELL, LTD., 96, Victoria Street, S.W.1.— List 25, containing illustrations and prices of "Linolite" lamps, reflectors, signs, and other fittings.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—An illustrated leaflet giving prices of "Pearl Elasta" gasfilled lamps.

THE DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, Middlesex.—Three pamphlets, dealing respectively with the "M.S." system of automatic temperature regulation, a radiator steam trap, and the "Drayton" temperature recorder. Priced and illustrated.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.— Catalogue 650, containing full particulars and prices of "Siemens" h.t., l.t., and grid bias radio batteries. Notes on the care and management of batteries are included.

Trade Announcements.

Mr. A. W. REEVES, M.I.M.E., F.R.S.A., has been appointed as technical sales representative in the North of England for Electricars, Ltd. Mr. Reeves was associated with Messrs. Crossley, Ltd., for many years, and later with Enfield-Allday Motors, Ltd., as technical director.

Messrs. WILLIAMSON BROS., electrical and wireless engineers, have removed their business from Mirfield to Shepley Bridge, Ravensthorpe.

Hitherto the HYDRAULIC ENGINEERING CO., LTD., Chester, has manufactured "Mangnall-Irving" thrust borers for sale only. From September 1st the company is opening a department for carrying out actual work in the London area with these machines.

MESSRS. JAMES GORDON & CO., LTD., have taken over the patent rights for the British Empire, except Canada, and also for all other European countries and their colonies of:— "Hagan" patent automatic regulation for combustion, boiler houses, &c.; the "Hall" patent system of boiler water conditioning; and the "Hagan" patent steam separator. The new "Hagan" department is under the management of Mr. J. E. O'Breen.

The ALDERSHOT GAS, WATER & DISTRICT LIGHTING CO. is opening, on September 1st, an electrical showroom at North Farnborough.

Mr. M. MELLOR has commenced business as an electrical and radio engineer at Gatefield Lane, Faversham.

Mr. R. C. ROBERTS, late of Standard Telephones & Cables, Ltd., has joined the Hotpoint Electric Appliance Co., Ltd., as representative for the Midland Counties.

Price Reductions.

The HART ACCUMULATOR CO., LTD., has made a substantial reduction in the prices of its "Ray" h.t. accumulators for radio work.

Book Notices.

"Running, Maintenance and Repair of Diesel Engines," by P. H. Smith. Pp. 159; figs. 87. Price, 3s. 6d. net; "Diesel Engines for Land and Marine Work," by A. P. Chalkley, sixth edition. Pp. xvi+320; figs. 196. Price, 24s. net. London: Constable & Co., Ltd.

"*Journal* of the Institution of Electrical Engineers." Vol. LXV. No. 368. August, 1927. London: E. & F. N. Spon, Ltd. Price, 10s. 6d.

"Questions and Solutions in Telegraphy and Telephony, Grade I Examinations." By H. P. Few (Solutions). Pp. 345; figs. 233. London: S. Rentell & Co., Ltd. Price, 6s. 6d. net. —This book contains the questions set by the City and Guilds of London Institute in Grade I of telegraphy and telephony for the years 1904 to 1919, and 1925, with the solutions.

"The Art and Craft of Cable Jointing." By C. G. Watson, M.I.E.E. Pp. 96; figs. 32. London: Sir Isaac Pitman & Sons, Ltd. Price, 6s. net.—The engineer and jointer would both do well to study the contents of this practical but unusually interesting little book. It outlines the modern methods of cable jointing and deals with the difficulties and failures common to present day jointing, with a reasoning which should appeal strongly to the practical man.

"Fundamentals of Electrical Design," by A. D. Moore. Pp. xxi+353; figs. 124. London: McGraw-Hill Book Co., Inc. Price, 20s. net.

"Electric Elevators," by F. A. Annett. Pp. xii+447; figs. 351. London: McGraw-Hill Book Co., Inc. Price, 25s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI. August, 1927. New York: The Institute. Price $1.

Bankruptcy Proceedings.

J. F. FAULKNER and A. E. FAULKNER, trading as J. F. and A. E. Faulkner, wireless and cycle dealers, 20, Market Street, Penistone, Yorks.—The public examination of these debtors was held on August 18th, at the County Court Hall, Barnsley. The statement of affairs showed a deficiency of £363. The debtors commenced business in 1924 with £15 borrowed money which was eventually repaid. They removed to their present address in December, 1925, and spent £90 to £100 in electric lighting and effects, although they were only on a monthly tenancy. They became aware of their position six months ago, but had continued, hoping that trade would improve. The examination was closed.

G. S. DOUTHWAITE, trading as G. S. Douthwaite & Co., 25, Dean Street, Newcastle-on-Tyne, electrical engineer.—The public examination of this debtor was held on August 18th, at the Court House, Newcastle-on-Tyne. The deficiency was put down at £1,642. Debtor said that the business was successful for a time. He had paid £1,600 for stock which only proved to be worth £800. The examination was adjourned.

G. R. HINDLE, 8, Hillside Avenue, Darwen, electrician.— Receiving order made August 11th on debtor's own petition. First meeting, August 29th, at the Official Receiver's offices, 11, Winckley Square, Preston. Public examination September 14th, at the County Court House, Victoria Street, Blackburn.

A. E. HUMPHREYS, 20, St. James Square, S.W., electrical engineer.—Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2, appointed August 5th.

Company Liquidations.

SERVICE RADIO CO., LTD.—Meeting of members September 23rd, at 27, Chancery Lane, W.C.2, to hear an account of the winding up from the liquidators, Messrs. J. Levy and W. Osborne.

ARROTA ELECTRICAL & MOTOR ACCESSORIES CO., LTD.—General meeting of members at 36 and 37, Queen Street, E.C.4, on September 20th, to hear an account of the winding up from the liquidator, Mr. S. P. Child.

Employment during July.

The *Ministry of Labour Gazette* reports that employment in the engineering industry during July remained slack on the whole. In electrical engineering employment continued fairly good, but showed a slight decline. The "overall" figure for unemployment in the engineering industry rose from 8.5 to 8.7 per cent., and in the electrical branch there was a rise from 4.7 to 4.9 per cent. There was also an increase in unemployment in the electrical wiring and contracting industry—from 7.0 to 8.0 per cent. A decrease occurred in the electric cable, wire and lamp manufacturing group—from 7.5 to 6.6 per cent. The actual numbers of unemployed were as follows, on July 25th:—Engineering, 86,741; electrical engineering, 3,790; electrical wiring and contracting, 1,115; cable, wire and lamp manufacturing, 5,845.

The French Electrical Industry.

The report of the board of the Union des Syndicats de l'Electricité states that the activity of the electrical manufacturing industries somewhat slackened during 1926 as a result of the general economic difficulties, but on the other hand, the exports continued to develop. The foreign trade was reflected in a considerable excess of the exports, which, after having slightly decreased in 1925 in relation to 1924, reaches values in 1926 which were greater than in any previous year. Concerning the production and distribution of electricity, the report states that so far as can be judged from the reports of the large companies, the consumption *per capita* continues to grow rapidly. In general, the consumption in kilowatt-hours increases by about 10 per cent. per annum. As the average consumption *per capita* was 250 kWh in 1925, it is probable that the consumption in 1926 was about 275 kWh, which would place France in the first position in Europe after Scandinavia and Switzerland, which

have developed their hydro-electric works to a larger extent than France. The report states that the French producing and distributing companies have made remarkable efforts in recent years to promote the electrification of the country. While there were only 5,431 communes electrified in 1914, at present there are almost 17,000—44 per cent. of the total number of communes in France; and over 1,000 communes are now in process of electrification.

The Timber Trade.

Our Timber Trade Correspondent reports that the demand for the softwood varieties has been satisfactory over the past month, holidays considered, but the country is being well supplied with foreign, as well as, to a lesser extent, Empire produce. Values of timber on the spot are increasing in sympathy with advancing f.o.b. prices. Imports of sawn hardwoods have been arriving very freely, and stocks of the lower grades are large at moderate rates, American woods particularly. The better qualities of hardwoods in the log, planks and boards are only in moderate supply, with prices firm; the market, however, at present is slow. There are also good lines of English oak, ash and other woods that for real service cannot be surpassed.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price August 23rd.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£62	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£26	...
a Copper Sulphate ... ... ,,	£35 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£11	30s. inc.
a ,, Roll ... ... ,,	£11	30s. inc.
a Soda, Chlorate ... ... per lb.	3¼d. to 3½d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	3¼d.	¼d. dec.
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£254	...
Grade II ... ... ,, ,,	£175	...
Grade III... ... ... ,, ,,	£89	...
c Brass (rolled metal 2' to 12' basis) per lb.	9¼d.	...
c ,, Tubes (solid drawn) ... ,,	11¼d. to 11¾d.	...
c ,, Wire, basis ... ... ,,	9¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	...
c ,, Bars (best selected) ... per ton.	£86	...
c ,, Sheet ... ... ,,	£86	...
c ,, Rod ... ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£62 10s.	...
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£72 10s.	...
d ,, ,, H.C. Wire per lb.	9¾d.	...
f Ebonite Rod ... ... ,,	2/6 to 2/8	...
f ,, Sheet ... ... ,,	2/6 to 2/6	...
a German Silver Wire ... ... ,,	2/2	...
b Gutta-percha, fine ... ... ,,	8.-	...
b India-rubber, Para fine ... ... ,,	1/4	¼d. inc.
l Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£24 5s.	5s. dec.
g Mercury ... ... per bot.	£21 15s. to £22	...
e Mica (in original cases) small ... per lb.	3d. to 5/-	...
e ,, ,, medium ,,	4/- to 5/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£14 10s.	...
d Silicium Bronze Wire ... ... per lb.	10½d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£226 5s. to £227 5s.	£6 to £6 10s. dec.
z ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd
g James & Shakespeare.
h Edward Hill & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.

W. F. Dennis & Co.

In their letter dated August 20th, Messrs. James Forster and Co. state that closing prices on August 19th were £22 15s., for August, and £23 2s. 6d. for November, against £23 3s. 9d., and £23 13s. 9d. respectively at the end of the preceding week. Heavy selling on Tuesday (August 16th), totalling about 3,500 tons, reduced values about 5s. per ton, but there was a recovery on Wednesday and Thursday. On Friday the market again weakened on a renewal of fairly heavy offerings of October and November lead, with the result that August shipment lead declined to £22 15s., this figure being the lowest recorded on this market for several years. October lead declined to £23, and November to £23 2s. 6d. The Board of Trade returns for July, 1927, show imports of 26,431 tons and exports of 1,809 tons, leaving 24,622 tons for home absorption.

New Irish Free State Patent Act.

Messrs. Rayner & Co., patent agents, call attention to the new situation which will be created by the coming into force of the new Patents and Trade Marks Act in the Irish Free State on October 1st. Previously, British patents and trade mark registrations have covered the whole of Ireland, but when the new Act is in force, they will automatically cease to function in the Free State. It is necessary, therefore, for all holders of British patents and trade marks desiring to retain protection to take out fresh patents or trade marks there. British patents granted before December 6th, 1921, however, will be continued upon the Irish register, if a copy of the patent is lodged in Ireland and renewal fees are paid as in England. Similar privileges apply to registered trade marks and designs. In the event of an application for a patent being made without reference to any earlier British patents, it must be accompanied by the report of a registered patent agent, based upon a search for novelty in the British records. Further information on this important subject can be obtained from Messrs. Rayner & Co., 5, Chancery Lane, W.C.2.

Threatened Strike at Stepney.

The district auditor recently directed that the wages of employés of the Stepney Borough Council were to be reduced to conform with the requirement that wages must not exceed by more than 10 per cent. the trade union rates and Joint Industrial Council awards. Upon the reductions being notified to those concerned, the employés of the Electricity Department alleged that their wages were to be reduced to a greater extent than those of men in other departments. A mass meeting was held, when it was decided by a large majority that if negotiations with the Council were unsuccessful the men should cease work as a protest.

Unemployment.

During the week ended August 8th there was a fall of 95,130 in the number of registered unemployed. At that date the total was 1,024,700, as compared with 1,119,830 on August 1st, and 1,594,170 on August 9th, 1926, when the coal dispute was in progress.

The German Electrotechnical Industry.

The *Deutsche Bergwerks Zeitung* says that, although the stock of orders in most branches of the German electrotechnical industry may be regarded as satisfactory, the number of fresh orders received leaves something to be desired at many works. It is expected, therefore, that the present good volume of business will begin to diminish in the near future. The works are greatly inconvenienced by the fact that the public authorities do not place their orders steadily throughout the year; most of the contracts are not awarded until late in the summer, and deliveries are required during the autumn. No material improvement has yet taken place in export business, which is being hampered chiefly by the frequent alterations in the Customs duties in many countries.—*Reuter's Trade Service* (Essen).

For Sale.

By order of the liquidator, Mr. R. G. Pye, Messrs. Leopold Farmer & Sons will sell by auction, on September 15th, at 95, White Lion Street, Islington, N.1, the plant and machinery of the Goswell Engineering Co., Ltd. (See our advertisement pages to-day.)

A Boiler Manufacturing Development.

It is reported that Babcock & Wilcox, Ltd., have acquired control of the Vickers Boiler Co., a subsidiary of Vickers, Ltd.

Lighting and Power Notes.

Barnoldswick.—Electricity Supply.—The Electricity Committee has instructed its engineer (Mr. R. Blackmore) to revise his figures regarding capital expenditure on the electricity scheme. The clerk has also been instructed to obtain details of bulk supplies from various concerns. When this information is obtained the Committee will decide whether the Council shall proceed with the scheme at once.

Bexhill.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. O. A. Frost) for the year ended March 31st last record a total revenue of £35,484, as compared with £34,778 in 1925-26. Working expenses amounted to £22,449, as against £22,439, leaving a gross profit of £13,035 (£12,340), to which was added interest of £302, making a total of £13,337 available. After providing for capital charges, there was a net surplus of £3,648, as compared with £3,143 in the preceding year. The sales of electricity increased from 1,787,146 to 2,155,926 kWh. The generating plant at Ashdown Road was finally shut down on April 1st, and the general bulk supply arrangement with Hastings Corporation came into force. Two 1,250-kW motor convertors with the necessary switchgear were installed during the summer.

Blackburn.—ELECTRICITY ACCOUNTS.—A special meeting of the Town Council was held on August 18th to consider the annual report of the electrical engineer and the abstract of accounts for the electricity department for the year ended March 31st last. The debate turned on the question of the coal stock and of the cost of producing electricity. The accounts were approved and the report of the electrical engineer was referred to Mr. Dykes, the expert appointed by the Council to inquire into the Electricity Department, with a direction that his special attention be drawn to the above points.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Work on the Grand Falls hydro-electric development, which will eventually supply power for pulp and paper mills in New Brunswick, and for other purposes, is now some five or six months ahead of schedule, and it should be ready for the installation of machinery before the winter. Between 350 and 400 men are now employed on building the dam and the power house, and in driving a tunnel 2,700 ft. long which passes right under the main business section of Grand Falls and will carry the water from the dam to the generators, three in number, each capable of developing 20,000 h.p.

Chesterfield.—COLLIERY PLANT.—The second of three gas engines for the generation of electricity has been installed at the Devonshire works of the Staveley Coal & Iron Co., Chesterfield. The inaugural ceremony was performed by Miss Fawsett, of Hope. The Company is now in a position to supply continuously electricity for public and works consumption, up to from 16,000 to 18,000 kWh daily. A third engine is being constructed, and this will be utilised as a stand-by.

Continental.—SPAIN.—A new hydro-electric power station known as the Escarella has lately been completed at Panticosa, province of Huesca, by the Societad Energia e Industria Aragonese. The plant, which utilises the power of certain falls on the Bafo Caldare river, comprises two Pelton turbo-generators each of 4,200 kVA capacity. Electricity is generated at 2,300 V and stepped up to 66,000 V for transmission to the company's central station at Biescas to supplement the output of the latter.

FRANCE.—The Société Energie Electrique du Littoral Méditerranéen, of Paris, has recently secured a concession for the establishment of three hydro-electric plants to utilise the falls of the Baucairon, Courbaisse and St. Etienne Lacs on the River Tinée in the Alpes Maritimes.

Although 50-period three-phase a.c. has for some time been standardised in France, Paris has until lately been supplied either with d.c. or single or two-phase 42-cycle a.c. The Compagnie Parisienne de Distribution d'Electricité is, however, now engaged in changing over from 42 to 50 cycles.

Glasgow.—YEAR'S WORKING.—We have received from Mr. R. B. Mitchell, engineer and manager of the Corporation electricity undertaking, a copy of his report, together with the statement of accounts for the year ended May 31st last. The total revenue amounted to £1,391,101, as compared with £1,195,003 in the preceding year. As a result of the coal dispute, the cost of fuel increased by £164,886, and working expenses therefore rose from £601,293 to £806,328. The amount written off for depreciation was £110,957, and the gross profit was £473,816, as against £490,150, from which the following charges had to be met:—Interest, £301,871; sinking fund, £254,616; instalments of principal of money borrowed, £2,168; changing system of supply from d.c. to a.c., £12,464. The net result therefore was a loss of £97,304, as compared with a loss of £29,329 in the previous year. The capital expenditure during the year amounted to £485,936, and included £123,004 for machinery and plant at Dalmarnock station, and £275,247 for mains and cables. The total amount now spent on the undertaking stands at £8,182,294. The sales of electrical energy increased from 186,742,044 to 191,789,688 kWh, and the total connected load from 232,287 to 254,228 kW. The average gross receipts per kWh increased from 1.5358d. to 1.7408d., and the average cost per kWh sold from 1.5735d. to 1.8625d. During the year five sub-stations were put into commission, and several others are in course of erection. Mains laid included two miles of l.p. and seven miles of h.p. feeders and 41 miles of distribution cables. The number of domestic appliances in use amounted to 74,993, of which 15,090 were hired. This represents a load of 104,860 kW.

PROGRESS OF REFUSE WORKS.—The Corporation Superintendent of Cleansing reports that satisfactory progress has been made with the erection of the new refuse power works at Govan. The Committee, in accordance with the recommendation of the Electricity Commissioners, revised the contract for the generator house, whereby 50-cycle plant will be installed in lieu of the 25-cycle plant. Application has been made to the Commissioners to have the new works recognised as a generating station under the Electricity Supply Act, 1919, and it is confidently anticipated that the Commissioners will transmit their official consent to the establishment of the generating station under Section II of that Act. The works are expected to be in operation before the expiry of the next financial year.

Greenock.—EXTENSION OF SUPPLY.—The Electricity Committee has reported to the Corporation that it has agreed, in view of the difference of opinion regarding the proposed scheme to supply Inverkip and Wemyss Bay with electricity, that a joint report be prepared by the Town Chamberlain and the engineer, which would be considered by the Committee and the Corporation.

Hastings.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer, Mr. R. F. Ferguson) for the year ended March 31st last, shows a total revenue of £89,417, as compared with £69,541 in the preceding year. The coal dispute was responsible for an increase in working expenses from £38,951 to £58,354, and there was a gross surplus of £31,063, as against £30,590. Capital charges absorbed the whole of the gross profit, the net result being a deficit of £748. The previous year's working resulted in a surplus of £3,542. The capital expenditure during the year amounted to £46,681, the chief items being £16,572 for mains, and £9,271 for services. The electrical energy sold increased from 5,395,157 to 8,446,263 kWh, and the maximum supply demanded from 3,700 to 5,080 kW.

Leeds.—LOAN.—The Corporation Electricity Committee is applying for sanction to the borrowing of £10,000 in connection with its assisted wiring scheme.

London.—ST. MARYLEBONE.—The Borough Council Electricity Committee has received consent to a loan of £20,000 for mains and services.

ST. PANCRAS.—The Electricity Committee has had under consideration the terms for a supply of electricity to the factory of Messrs. Carreras, Ltd., in Mornington Crescent. Negotiations have been in progress, and the proposals are based on a maximum demand charge as in the case of the bulk supply to to the London and North-Eastern Railway Company. The supply will be at 5,000 to 5,200 V, 50 cycles, and the chief electrical engineer advises that the £1,900 per annum, paid in advance, will cover the expense in providing plant to handle the supply, the demand being taken at 500 kW. Messrs. Carreras, Ltd., have agreed to the terms.

Northern Ireland.—LARNE (CO. ANTRIM).—An agreement has been entered into by the Urban District Council with the local Electric Light & Power Company for the lighting of the streets of the town for a period of three years at a cost of £1,080 per annum.

BALLYCASTLE (CO. ANTRIM).—At a recent meeting of the Urban District Council a letter was received from the Electricity Commissioners relative to the recent inquiry. The Commissioners asked whether the Council had considered the Ballycastle Electric Light & Power Company's proposal that provision should be made for the purchase of the undertaking by the Council at any time after the expiration of twenty years from the date of commencement of the Special Order. The chairman said the Council would not be so anxious about the period of option for purchase of the undertaking if the Commissioners would guarantee that they would have a reasonable charge fixed in the Order for both private and street lighting. It was unanimously resolved that the Council's solicitor be instructed to request the Commissioners to fix the charge for private consumers at 10d. per kWh and for street lighting at 7d. per kWh, the street lighting to be metered by the Council, in which case the Council would not object to the term of the period for purchase of the undertaking being fixed at twenty years.

Peterborough.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. H. A. Nevill) for the year ended March 31st last shows a total income of £105,046, and working expenditure of £71,903, leaving a gross profit of £33,143. The figures for the preceding year were:—Income, £70,006; working expenses, £31,775; gross profit, £48,231. To the gross profit was added revenue from other sources making a total of £35,906. Capital charges, and capital outlay charged to revenue absorbed the whole of this surplus, and there was a net deficit of £1,738. The capital expenditure during the year amounted to £142,033, and included £64,247 for the purchase of land, £45,360 for plant and machinery, and £20,308 for mains and services. The electrical energy sold increased from 10,019,230 to 15,898,343 kWh, and the maximum supply demanded from 4,300 to 5,440 kW. Sanction was received during the year to the installation of one 6,000-kW set, and in July last approval was given to the further extension of the power station by the installation of a 12,500-kW turbo-alternator.

Plymouth.—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £150,000 for the provision of mains and services.

Preesall (Lancashire).—ELECTRICITY ON POULTRY FARMS.—The Electricity Committee has fixed the price of electricity for incubator and other poultry purposes at 3d. per kWh.

Prestwich.—STREET LIGHTING.—The Urban District Council has asked the surveyor to prepare a statement and estimate of cost of converting the existing street lamps from gas to electric lighting.

ALL-ELECTRIC HOUSES.—The Housing Committee has decided upon the following equipment for the all-electric houses:—Metro-Vick small standard cooker, including 3-pint electric kettle; 10 gallon washing boiler; one 2-kW electric portable fire; and heating plugs in the sitting room and the three bedrooms.

Saffron Walden.—ELECTRICITY EXTENSIONS.—The Town Council has recently completed extensions at the power station, which have increased the capacity of the plant to 160 kW. An exhibition of domestic electrical appliances was opened yesterday, and will remain open until to-morrow, during which the public will be permitted to inspect the new plant installed at the station.

Skipton.—Electricity Supply.—The local Chamber of Trade recently protested against the Urban District Council's refusal to accept an offer by the Electrical Distribution of Yorkshire, Ltd., to acquire the town's electricity undertaking. The Council deferred the matter for further consideration; but on August 16th the General Purposes Committee announced that it had decided that in the best interests of the town the Council should continue to be the supply and distribution authority.

South Molton.—Inauguration of Supply.—The electricity works installed by the South Molton and District Electrical Undertaking were formally opened by the Mayor on August 12th. The plant includes two 25-h.p. gas engines and two generators, and another generator is being installed. The generators are driven by water from the river Mole. While the main source of power is water, gas power is available if required, but it is not anticipated that gas power will be wanted for more than about three months in the year.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them granted to the Urban District Council of Portmadoc for the supply of electricity by the Electricity Distribution of North Wales and District, Ltd., within the urban district, and to the Sidmouth Urban District Council to supply in part of the rural district of Honiton.

Stoke-on-Trent.—Electricity Supply.—Mr. T. E. Rickinson has asked the Corporation to supply electricity to houses being erected in Park Road, Fenton, and the Electricity Committee is considering the laying of mains at a cost of £1,200.

Wakefield.—Supply of Electric Irons.—The Corporation has authorised the Electricity Department to supply electric irons on the hire-purchase system to tenants of the 50 all-electric houses on the Snapethorpe housing estate.

Wallasey.—Extension of Plant.—We are informed by Mr. B. T. Hawkins, borough electrical engineer, that the contracts for the extension of plant referred to in our last issue have been placed. No further schemes are contemplated or going forward.

Weardale (Co. Durham). — Electricity Scheme. — The Rural District Council has decided to proceed with the scheme to provide the whole of Weardale with an electricity supply. The estimated cost of the scheme is £52,000.

Weybridge. — Electricity Supply. — The Urban District Council has communicated with the Walton-on-Thames Urban District Council relative to its proposal to purchase the portion of the undertaking of the Urban Electric Supply Co. serving Weybridge, and inquiring whether the Walton Council would consider the question of joint management of the two undertakings. The Walton Council has replied that it is prepared to consider the matter when the time arrives. It has deferred purchasing the local undertaking until October 1st next.

Tramway and Railway Notes.

Bolton.—Tramcar Improvements.—The Tramways Committee has decided to cover in the upper decks of 30 of its older tramcars. The work is to be done in the tramway department's workshop.

Continental.—Spain.—What is claimed to be the longest electrically-operated cable ropeway in Europe has recently been completed by the Empresa de Tranvias Electricos de Granada, between Durcal and the Mediterranean port of Motril, a distance of just over 21 miles.

Heywood. — Light Railway Order. — The Minister of Transport has issued an Order under the Light Railways Acts authorising the construction of a light railway or tramway along Hollin Lane and Heywood New Road, in the boroughs of Heywood and Middleton. The tramway will be constructed and worked by the Manchester Corporation on behalf of the Corporations of Heywood and Middleton.

Leeds.—Tramway Extension.—The Corporation Tramways Committee has decided to extend the Middleton tramway to the end of Hopewell View.

The Committee has decided to allow powers for the construction of the following tramways and tramroads to lapse:—From York Road, *via* Pontefract Lane, to East Park Road; Victoria Avenue to Cross Green Lane: From Dewsbury Road, *via* Jack Lane, to the junction of Moor Road and Moor Crescent (partly tramway and partly tramroad); from Leeds and Guisley Road to Butcher Hill; from Balm Road to Hopewell View (partly tramway and partly tramroad).

London.—Breakdowns.—Trains were slowed down and in several cases stopped on August 18th by the failure of electricity on all Underground Railway lines, with the exception of the Central London Railway. The Underground Railway issued the following statement: "The failure of an electric cable at the Lots Road power station at 8.52 a.m. caused a temporary interference with the current supply to the Underground lines. Some half a dozen trains on the Edgware extension were brought to a standstill for about forty minutes, and on the District Railway, Bakerloo, Piccadilly, and Hampstead, there was no actual stoppage of trains, though speed was reduced by about 30 per cent. At 9.3 there was an improvement in the current supply, and at 9.26 the full supply was available and trains were normal."

The whole of the L.C.C. tramway system was brought to a standstill twice on August 22nd. The first stoppage occurred in the afternoon and lasted about 15 minutes. The second, which occurred in the evening, was more serious. Some of the cars resumed running after half an hour, but others were held up for an hour and 40 minutes. The stoppages were due to a breakdown at the Greenwich power station.

Newcastle-upon-Tyne.—Inquiry Result.—The Minister of Transport has given his decision with regard to an application by the Tynemouth and District Electric Traction Company, Limited, for an Order compelling the Newcastle Watch Committee to license 17 omnibuses to run from the city boundary at Wallsend into Newcastle to complete the through service to the coast. *The Times* states that the Minister has upheld the decision of the Watch Committee. The official inquiry was held on July 27th, and the application was resisted by the Corporation, notwithstanding the offer of the company to charge on its omnibuses such non-competitive fares as the Minister might decide. The capital expenditure incurred by the Newcastle Corporation in laying down the tramway outside the city boundaries amounts to £249,178, and the ever-increasing activities of private omnibuses occasion grave concern as to the future of these lines. It is thought that the decision in this case represents a wish on the part of the Minister to afford some protection to authorities which have invested large sums in tramway undertakings. The Newcastle tramways have already been severely hit, the number of passengers carried last year having decreased by 11,200,000, as compared with the previous year.

Plymouth.—New Cars.—The Corporation Tramways Committee has received sanction to the borrowing of £30,000 for the purchase of new tramcars.

Southern Railway.—Fusing of Cables.—The Southern Railway on August 16th issued the following statement:—The electric services on the Southern Railway between Orpington, Victoria, and St. Paul's, which were affected by the fusing of cables on August 15th, were running with the full number of trains on the following day, but owing to the defect not having been fully remedied, were operated at slightly reduced speed and may be so operated for a further period. A number of cables in a deep shaft to Penge Tunnel fused, and the exact cause has not yet been ascertained, but it is possible that it was due to an accumulation of water following the heavy rainfalls.

Telegraph and Telephone Notes.

Greece.—Wireless Services.—The Posts, Telegraphs and Telephones Department is, says the *Financial News*, considering the installation of wireless stations for communication with the Islands and Crete. It is proposed that there should be stations at Athens, Chios (Scio) and at Candia (Crete). Further stations would be established at Laurium and in Crete for communication with vessels in the Archipelago and in the Mediterranean Sea.

Hungary.—New Radio Station.—The Hungarian postal authorities are reported to have recently placed an order with the German Telefunken Gesellschaft, of Berlin, for the equipment for a powerful wireless transmitting station which is to be established about 7½ miles from Budapest, where two 492-ft. antenna masts about 980 feet apart are at present in course of erection. It is expected that the new station will be ready for operation early in 1928.

Jugo-Slavia. — Telephone Service. — The Jugo-Slavian Government propose to lay a series of new telephone trunk cables to link up important centres in different parts of the country, and to increase the facilities for conversation with important cities abroad, such as Vienna, Budapest, Prague, Brunn, and others. New exchanges for internal communication are also to be established at Belgrade, Ljubljana, and Nish, while exchanges reserved entirely for communication with other countries are to be installed at Belgrade, Zagreb, Maribor, and one or two other places. The main trunk lines to be established are four in number: one from Belgrade to Subotica and Horgos, on the Hungarian frontier; the second between Ruma, Brod, and Zagreb; the third from Zagreb *via* Sevinca to Maribor and the Austrian frontier, and the fourth between Belgrade and Nish.

Russia.—Long-distance Telephony.—The Mukden and Soviet authorities have concluded agreements for providing long-distance telephone services between Harbin and Chita

and Harbin and Vladivostock. The total cost is estimated at $1,500,000, which will be borne equally by the Russian and Mukden authorities.

According to the *Financial Times*, a telephone cable service between Berlin and Moscow is to begin next autumn.

Switzerland.—RAILWAY TELEPHONY.—In order to simplify and hasten intercommunication between different branches of the services of the Federal Railways, a central telephone office has been opened at the Razude for linking up the first ward (" arrondissement ") with Berne, as well as the Lausanne bureaux and stations (passenger, goods, &c.). The telephones are automatic, and are strictly limited to the use of the Swiss Federal Railway staff.

AUTOMATIC TELEPHONY.—The task of switching over to automatic working of the Selnau telephone exchange in Zurich was successfully carried out during the early hours of Sunday, August 14th, over 10,000 connections having to be dealt with.

The Telephone Service.—LONDON'S TANDEM EXCHANGE.—For the first time in this country a Tandem mechanical telephone exchange came into operation in London on August 18th, as a preliminary to the opening of automatic exchanges. Situated in Holborn, it has been provided to collect from all exchanges in the London area calls to all other exchanges between which there is no direct line, as the amount of traffic is not sufficient to justify the installation of cables for direct communication, and in so doing stages of " verbal communication " are cut out. This increases speed and efficiency and reduces the possibility of a wrong number. At the Tandem exchange the operators wear the ordinary headpiece, but they never speak. In front of them is a keyboard of letters and figures and lamps. When the Tandem operator hears " Brixton 3763 " she taps on her keyboard " Bri " for the exchange and " 3763 " for the number. The Brixton operator has a tablet in front of her on which the number " 3763 " appears. She then connects in the ordinary way. The keys operate a " sender " that sends out current to actuate automatic switches which select the junction to the required exchange and also send a series of signals which light appropriate lamps below the operator's board.

NEW AUTOMATIC EXCHANGE.—The Mayor of Burnley (Mr. Jas. Sutcliffe) opened the new telephone exchange on August 20th, when there was a change over from the manual to the automatic system. The new exchange has taken two years to erect.

TELE-TALKATIVE AMERICA.—Statistics published by the American Telephone and Telegraph Company show that the telephone user in the United States makes an average of 191 calls each year, whereas the English subscriber makes an average of only 23 calls. Thus, in six weeks the American gets as much value from his telephone as the Englishman gets in twelve months.

Radio Notes.

Continental Relays.—TESTS.—Experiments are in progress to determine the possibility of relaying programmes to this country by land line from the Continent. It is considered that the best route for such programmes is *via* Ostend, whence a new submarine telephone cable has lately been laid to England. Accordingly a " repeater " station has been installed at Ostend, so that programmes may be amplified before crossing the Channel. On this side the programmes will be conveyed to Savoy Hill by real " wired wireless," whereby a number of signals can be sent simultaneously along one wire, each group of signals being modulations of a carrier wave of a certain wave-length. The advantage, apart from economy in the number of cables necessary, is the elimination of much land-line distortion. Recent tests were conducted with music played in Ostend, which thus did not have to travel any considerable distance on Continental cables which, it is feared, would introduce new factors of distortion.

Empire Broadcasting.—PROPOSED ASSOCIATION.—Mr. H. Anthony Hankey, representing the Wireless Association of Great Britain, is shortly to visit the Dominions and Colonies in connection with Empire broadcasting. *The Times* explains that it is intended that the visit shall culminate with the formation of an Empire Broadcasting Association to deal with every aspect of the matter.

Regional Distribution.—NEW STATION INAUGURATED.—The new 30-kW experimental station (5 GB), after tests on August 19th and 20th, commenced to transmit at a frequency of 610 kc. (wavelength, 491.8 metres) on August 21st. Transmission is good, cone-speaker reproduction 8 miles west of 2 LO being equal in quality to that of the London station and decidedly stronger than that of the long-wave Daventry plant. The new station is situated a few hundred yards from Daventry (5 XX), and at first will use two " T " aerials supported on two pairs of 110-ft. masts; energy will be supplied to the aerials by transmission lines a few hundred yards long. Two 325-ft. masts are being erected for further experimental work. The transmitter has been designed and erected entirely by the B.B. Corporation's engineers, and at present it is in rough form, having been built up as experiments proceeded; it is not equipped with spare machinery in the same way as are other stations, and for this reason it may not have the same degree of reliability. The transmitting circuit differs from that used in the older stations of the B.B.C., since modulation takes place at comparatively low power and the modulated carrier is magnified by a power amplifier using water-cooled valves. A constant wavelength is maintained by a master oscillator, isolated from every influence which might tend to vary its frequency. The low-power and modulator valves are of the ordinary glass type; the anodes of the power valves are energised partly by a high-voltage direct-current motor-generator giving 10,000 volts, and partly by a bank of six water-cooled rectifying valves working directly from the supply mains and giving, with the aid of a smoothing circuit, the same d.c. voltage. This unusual arrangement has been adopted purely for experimental purposes. The supply mains are the same as those used for 5 XX, and an additional sub-station has been built for supplying 5 GB.

U.S.A.—ELIMINATION OF STATIONS.—Twenty radio stations in the New York metropolitan area have been notified by the radio supervisor of the Department of Commerce that because of repeated deviations from the wave-lengths assigned to them their licences will not be renewed unless they can " show cause." According to *World Radio*, about twenty-five stations are expected to discontinue broadcasting when new licences for sixty days are issued by the Federal Radio Commission. Over one hundred stations, the Commission says, declare they cannot continue broadcasting unless better wave-lengths are given to them, but the Commission does not expect them to discontinue operation. Some stations, however, in the opinion of a member of the Commission, are continuing to operate merely because of the belief of their owners that they have something which socner or later they will be able to dispose of advantageously.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" page, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Belgium.—September 7th. Belgian Post and Telegraph Authorities, La Salle Madeleine, Brussels. Three lots of telephone cable for Ghent, Lokeren, and Renaix, and five lots for Verviers, Liége, Spa, Pepinster, and Aubel. Specifications (Cahier des Chargés Special Nos. 3-257 and 3-269) for 12 fr. each.

Bulgaria. — PLOVDIV. — September 12th. Town Council. Supply of materials for and erection of a power station.—*Reuter's Trade Service* (Sofia).

Bury.—September 9th. Electricity Department. 10,000-kW turbo-alternator with surface condensing plant. (August 12th.)

Chorley.—August 31st. Electric lighting installation, St. Peter's Church. Specifications from R. Higham, 74, Park Road, Chorley.

Croydon.—September 5th. Electricity Department. One vertical spindle motor-driven borehole pump. (See this issue.)

September 6th. 20,000 tons of coal for use on chain-grate mechanical stokers. (August 19th.)

Edinburgh.—September 3rd. Corporation. Installation of electric lighting at three housing schemes (1,088 houses). Specifications from engineer's office, Dewar Place.

Egypt.—CAIRO.—October 1st. State Railways, Telegraphs and Telephones. Supply of underground cables, from £E6,000 to £E6,300. Firms should communicate direct with the Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1.—*Reuter's Trade Service* (Cairo).

Cairo.—October 12th. Egyptian Ministry of Public Works. Four Diesel alternator groups and accessories for the Atf power station. (A.X. 5028.)*

Grimsby. — September 5th. Electricity Department. Supply of p.i.l.c., l.p. cables for one year.
September 20th. One 500-kW convertor, transformer, l.p. switchgear, cable work, &c. (See this issue.)

India.—September 16th. India Store Department. Three 40-kW oil-engine generating sets, with cables and accessories. (August 19th.)

Leeds.—October 8th. 25,000-kW steam turbines, 3-phase alternators and exciters, surface condensing plant, &c. (August 19th.)

Liverpool.—September 1st. City Engineer's Department. 200 tons of steel tramway rails.

London.—September 13th. India Store Department. Two 30-kW oil engine d.c. generating sets, complete with cables and accessories. (See this issue.)

Luxemburg.—Following the recent decision of the Chamber of Deputies, the Government of the Grand Duchy of Luxemburg is inviting fresh offers, until September 19th, for the establishment and working of an electricity distribution system throughout the country. Tenders are to be sent to the Directeur-Général des Travaux Publics, Luxemburg. Particulars (Cahier des Charges) can be obtained for 75 francs from the Bureau d'Etudes et de Construction pour l'Electrification du Grand Duché de Luxemburg, 3, Avenue de la Liberté, Luxemburg.

New Zealand.—Wellington.—October 11th. Public Works Stores Department. Supply and delivery of 1,000—50,000-V insulators. (B.X.3742.)*
October 25th. 50-kV switchgear and steelwork for Waikato. (B.X. 3685-6-7-8.)* 10,000-kVA transformers for Waikato. (B.X. 3604.)*

Oldham.—September 12th. Board of Guardians. Electric lamps and fittings. Particulars from F. W. Fletcher, clerk to Guardians, Union Offices.

Pontypridd.—September 12th. Urban District Council. One 500-kW rotary convertor, transformer, and necessary switchgear. (See this issue.)

Preston.—September 12th. Electricity Department. Boilers, stokers, economisers, fans, chimneys, steam and feed piping for the Ribble power station. (August 19th.)

South Africa.—Durban.—October 6th. South African Railways and Harbours. 200-V switchboard for the Durban workshops. (B.X. 3739.)*
September 8th. Three 4-ton electrically-driven portal jib cranes. (A.X. 4991.)*
Cape Town.—September 21st. Town Council. Supply and delivery at the Dock Road power station stores of electric light poles, cross arms, insulators, binding wire, &c. Particulars from the city electrical engineer.

Stourbridge.—September 13th. Stourbridge and District Water Board. Pumping machinery, including a 5-kW, d.c. dynamo, 220 V, with switchboard and fittings. Particulars from G. Plant Deeley, consulting engineer, 13, Church Street, Stourbridge.

Stockport.—September 19th. Electricity Committee. One 20,000-kW turbo-alternator and surface condensing plant. (See this issue.)

Swindon.—September 10th. Corporation. Three 2,000-kW and two 500-kW rotary convertors with transformers; and six static transformers of from 500 to 2,000-kVA capacity. (See this issue.)

Tilbury.—September 22nd. Urban District Council. Electricity meters for 12 months. Carcassing of houses on the Council's housing estate, complete for lighting and cooking, and also for the installation of electric cookers in the houses. (August 19th.)

Wallasey.—September 17th. Electricity Department. Supply and erection of one 50-ton overhead electric travelling crane at Limekiln Lane power station. (August 19th.)

Warrington.—September 5th. Electricity Department. Twelve months' supply of earthenware conduits. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Cumnock.—Town Council. Accepted:—
Installation of electric light at the Town Hall at £195.—Cowan & Linton.

Leeds.—Tramways Committee. Accepted:—
Track work lay-out, Park Road and Boar Lane (£888).—Messrs. Edgar Allen & Co., Ltd.
Health Committee. Accepted:—
Renewal of storage batteries in connection with electric lighting installation at Gateforth sanatorium (£182).—Chloride Electrical Storage Co., Ltd.

Government Contracts.—The following contracts were placed by Government departments during July:—

Admiralty (Contract and Purchase Department).

Portable fuseboards.—Bertram Thomas.
Electric lamps.—General Electric Co., Ltd.; Metro-Vick Supplies, Ltd.; Siemens & English Electric Lamp Co., Ltd.; British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.
Insulating materials.—Ioco Rubber & Waterproofing Co., Ltd.; E. Macbean, Ltd.; Butterfield & Renton.
Bridge meggers.—Evershed & Vignoles, Ltd.
Automatic telephone exchange.—Relay Automatic Telephone Co., Ltd.
Bulkhead through terminals.—Pinnacle Switchgear, Ltd.

War Office.

Portable secondary batteries.—Chloride Electrical Storage Co., Ltd.
Electric cable.—Enfield Cable Works, Ltd.
Wireless telegraph sets.—Johnson & Phillips, Ltd.; Radio Instruments, Ltd.

Air Ministry.

Accumulators.—Chloride Electrical Storage Co., Ltd.; Edison Swan Electric Co., Ltd.; Fuller Accumulator Co., Ltd.
Inert batteries.—Edison Swan Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Building and works services.—Underground cables (Bicester).—Malcolm & Allan, Ltd. Generating set.—Babcock & Wilcox, Ltd. Wiring (I.E.).—Read and Partners, Ltd.
Ignition spares.—Delco-Remy & Hyatt, Ltd.
Transmitters and spares.—Johnson & Phillips, Ltd.
Wavemeters.—Siemens Bros. & Co., Ltd.

Post Office.

Manufacturing, supplying, drawing-in and jointing cable.—Brighton-Eastbourne: Standard Telephones and Cables, Ltd. Northampton-Stony Stratford: W. T. Henley's Telegraph Works Co., Ltd.
Electric lifts and gates (Metropolitan Exchange, E.C.2).—W. Wadsworth & Sons, Ltd.
Telephone exchange equipment.—Berkhamstead: Ericsson Telephones, Ltd. Maida Vale: Siemens Bros. & Co., Ltd. (Sub-contractors: English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries). Cambuslang (Glasgow): Siemens Bros. & Co., Ltd. Cowley, Headington & Summertown (Oxford multi-exchange area): Standard Telephones & Cables, Ltd. (Sub-contractors: W. Jones and Co., for ringing machines). Chigwell (Essex), St. Albans and Bristol (Relief): Standard Telephones and Cables, Ltd. Salisbury and Sale (Cheshire): General Electric Co., Ltd. British Electrical Federation, Ltd. (Kingsway, W.C.2): Automatic Telephone Mfg. Co., Ltd.
Telegraphic apparatus.—Creed & Co., Ltd.
Telephonic apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; International Electric, Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Testing, protective and miscellaneous apparatus.—Standard Telephones & Cables, Ltd.
Bell sets.—T. Watson (London, N.W.).
Terminal blocks.—Thos. de la Rue & Co., Ltd.
Telephone cabinets.—Ruston & Hornsby, Ltd.
Cable.—Connollys (Blackley), Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cables, Ltd.
Lamp caps.—B. W. Johnson (Nailsworth).
Joint box castings.—General Foundry & Engineering Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Porous cells.—General Electric Co., Ltd.
Vacuum cleaners.—Pulvo Engineering Co.
Loading coils (to encase).—General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephone cords.—Phœnix Telephone & Electric Works, Ltd.; Reliance Electrical Wire Co.
Generators.—Sterling Telephone & Electric Co., Ltd.
Switchboard wire.—General Electric Co., Ltd.
Rod zincs.—Locke, Lancaster, & W. W. & R. Johnson and Sons, Ltd.

Crown Agents for the Colonies.

Cable.—Callender's Cable & Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Standard Telephones & Cables, Ltd.
Electrodes.—Quasi-Arc Co., Ltd.
Lamps.—Falk, Stadelmann & Co., Ltd.
"Lux" cells.—Chloride Electrical Storage Co., Ltd.
Train lighting spares.—J. Stone & Co., Ltd.
Transformers.—Brush Electrical Engineering Co., Ltd.
Wire.—Shropshire Iron Co., Ltd.; Siemens Bros. & Co., Ltd.; Elliott's Metal Co., Ltd.

H.M. OFFICE OF WORKS.
Engineering services.—Crane.—Herbert Morris, Ltd.
Wiring Stirling Castle.—J. A. Coutts & Co. (Leven).

India.—BOMBAY.—Corporation. Accepted:—
Two sets of electrical gear for pumping station, Rs.1,430 per set.—Worthington-Simpson, Ltd.

London.—Admiralty. Accepted:—
Supply of helical traction lamps.—Siemens Electric Lamps & Supplies, Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
Erection of sub-station in Main Road, Muizenberg (£1,264).—F. H. van der Linden.
200 fuses (£200).—Saaler & Franks, Ltd.
Three sets of reactors (£804).—Metropolitan-Vickers Co., Ltd., through Davis & Soper, Ltd.
Finance Committee. Recommended:—
Installation of electricity at new municipal buildings at Muizenberg (£280).—S.W.S. Engineering Works.

Stirling.—Town Council. Accepted:—
Installation of electric light in houses on Drip Road Estate.—Graham & Morton.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

NEPONSET insulation.
Special wire resistances, enclosed in a glass globe containing an inert gas and fitted with a standard lamp cap.

Notes.

A Scottish Transport Conference.

A conference has been arranged this week between the two Scottish railway groups, the L.M.S. and the L.N.E.R., and the Glasgow Corporation Tramways Committee. *The Times* states that from the conference may arise an alliance between the parties to defend the railways and tramways against motor-omnibus competition.

Appointments Vacant.

Electrical engineer for Messrs. Preece, Cardew & Rider, required for Trinidad. Armature winder and motor mechanic for Bristol Corporation Electricity Department. Accountant (£800-£50-£1,000) for the Government of Ceylon. Assistant mains engineer ($400-$50-$750 per mensem, plus 10 per cent.) for the Municipality of George Town, Penang. Switchboard attendant, for Peterborough Corporation Electricity Department. Draughtsmen, Grades I, II and III, required for wireless design work at the Royal Aircraft Establishment. (See our advertisement pages to-day.)

Model Engineering Exhibition.

The tenth annual Model Engineers' Exhibition is to be held in the Royal Horticultural Hall, Westminster, from September 17th to 24th inclusive. A great attraction throughout the whole period of the Exhibition will be the first public demonstration of television and "noctovision" (seeing in the dark) by the inventor, Mr. J. L. Baird.

A Searchlight "Gun."

A long-range searchlight "gun," which can "shoot" pictures or images on to clouds or buildings at varying distances, depending on atmospheric and cloud conditions, has been perfected by the Illuminating Engineering Laboratory of the General Electric Company of America. This projector, which in external appearance, closely resembles a cannon, with its tapering barrel painted a battleship grey, is but a small model of larger "sky writers" which can be made, according to Mr. W. D'Arcy Ryan, director of the laboratory.

A searchlight is located at the rear end of the "gun," and in the barrel are lenses and a slot for inserting the slide which is to be projected. These lenses are so arranged that the image of the slide is in constant focus at any distance more than 20 feet from the end of the barrel, which makes it possible to cast the image about on various objects at different distances without refocusing. The image can be reflected in ever-changing colours by the use of an electrically-operated screen attached to the nozzle of the projector. The speed of this screen can be varied. Just as sky-writing with smoke from aeroplanes has proved popular, it is suggested that this new projector will find a place in advertising.

French Rural Distribution Charges.

The State charges in respect of rural distribution lines, masts and transformer cabins on public roads and land in France have recently been modified. For overhead or underground lines the annual rent is now fixed at 1 franc per metre in the Paris district, 20 centimes in all communes in the Seine Department and in all communes with a population of over 100,000 inhabitants, 8 centimes in those with between 20,001 and 100,000 inhabitants, 4 centimes in those with between 5,001 and 20,000, and 2 centimes in those with not more than 5,000. The annual rents for posts or masts in the above cases respectively are 100, 20, 8, 2, and 1 fr., while for transformer boxes or cabins the annual rents per sq. metre of land occupied are 200 fr., 40 fr., 16 fr., 4 fr. and 2 fr., respectively.

Electrically-welded Railroad Ties.

A recently completed test extending over a year has established the fact, it is claimed, that electrically-welded metal railway ties, constructed from worn rails, are not only ten times as strong as the ordinary wooden tie, but can be made at a very small cost. A number of sample ties were installed by the Delaware & Hudson Railroad, U.S.A., and arrangements are now being made to install equipment in the Railroad Company's shops for the construction of the metal ties. The design of the new equipment involves the use of two pieces of old rail for each tie. These are fastened together at each end by metal plates welded in position. The L-shaped angle bars used in ordinary rail joints are suitable for this purpose. In order to facilitate the easy and inexpensive construction of these metal ties, the General Electric Co., America, has designed a new type of automatic electric arc welding equipment, one of which is to be installed shortly in the Delaware & Hudson Railroad Co.'s shops.

Handicaps to Electricity.

Under this heading the *Morning Post* of August 17th quoted the speech addressed to the 1912 Club on August 9th by Major Theodore Rich, O.B.E., in which he criticised the Government regulations which handicapped the development of electricity in this country and drew attention to the resulting high cost of power lines. Inquiries made by a representative of the *Morning Post* led him to the conclusion that while there was some foundation for Major Rich's criticisms, the conditions were improving; "there is no doubt that facilities will have to be more easily obtainable if there is to be extensive rural electrical development in this country." In the same issue of the paper there appeared a letter from Col. R. E. Crompton, strongly supporting Major Rich's statements, to the effect that the Electricity Act of 1926 had done nothing to cheapen the distribution of electricity, which formed the major part of the cost to the consumer. In France the cost of overhead distribution lines was £120 a mile, whereas in this country it was £400 to £500, the difference, said Col. Crompton, being largely due to restrictive and cumbrous legislation, which the recent Act had not dealt with in any way. On August 19th a letter on the same subject appeared in the *Morning Post* from Sir James Lithgow, a member of the Central Electricity Board, who pointed out that British policy was to place upon those responsible for the conduct of industry such heavy obligations for the prevention of accidents, from whatever cause they might arise, as to add most materially to the cost of production of any article, or service, which they had to produce or render.

His own observations abroad led him to think that Continental policy was to rely upon the persons interested taking greater care of their own safety. It was an open question whether this did not engender a habit of carefulness which might be more effective than our costly regulations. The immediate result was certainly cheaper goods for the foreigner.

"It appears to be idle to complain of high selling prices obtained by trusts while the public applauds the efforts of such combinations in keeping the chief item of production costs—wages—at a level higher than can be attained in unsheltered world competition. Of course, that is a handicap, perhaps a fatal handicap, to British trade, but it is the national outlook, not the makers of half-crown fittings, that is responsible."

Boiler Explosion Report.

The Board of Trade has issued a report on a preliminary inquiry into the explosion of a stop valve, which occurred at the power station of the Chiswick Electricity Supply Corporation, Ltd., in December last. The valve was supplied as being suitable for use with superheated steam at a working pressure of 150 lb. per sq. in., and its globe-pattern chest was of cast-iron. The explosion was of a violent nature, and the portion of the chest on the outlet side of the valve was broken into not less than five pieces. The failure is attributed to water hammer action, but the evidence available did not indicate exactly how the action occurred. It is observed that it is not good practice to use cast-iron for valve chests and steam-pipe fittings which are subjected to the steam conditions employed in this station.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Alderman T. G. DOBB, chairman of the Borough Electricity Committee, has been invited to become Mayor of Leigh, Lancs., next November.

The Leeds Corporation Electricity Committee has made the following re-arrangement of staff consequent upon the resignation of Mr. R. P. WATSON, engineer-in-charge:—Mr. G HORNER, appointed shift charge engineer, Grade 8; Mr. W. WALKER, appointed shift engineer, Grade 8a; and Mr. E. D. REID, appointed assistant shift engineer, Grade 9a.

Mr. T. D. LYNCH, manager of the Materials and Process Engineering Department, of the Westinghouse Electric and Manufacturing Company, is on a two months' business tour of Europe. His main object is to study methods of manufacturing in Germany and England, especially the Siemens-Schuckert Co., of Germany, and the Metropolitan-Vickers Co., of Great Britain.

The marriage took place at Lexden on August 6th of Mr. H. J. HOOK, transformer engineer, Messrs. Johnson and Phillips, Ltd., and Miss I. Charge, of Lexden.

Upon his return to England, after some years spent in electrical engineering in the United States, including a period with the Westinghouse Co., Mr. G. I. WARE has joined the staff of Henrion Carbons, Ltd., as the manager of their dynamo and motor brush department.

Mr. J. FINLAY, deputy mains engineer of the Plymouth Corporation Electricity Department, was, on August 19th, presented by the staff and workmen of the Department with a mahogany clock as a farewell gift on his departure for South Wales, where he is taking up a new appointment.

Dr. C. E. SKINNER, Assistant Director of Engineering, and Mr. W. BRADSHAW, of the Supply Sales Department, Westinghouse Electric and Manufacturing Co., sailed on August 17th, as delegates to the International Electrotechnical Commission Convention, which is to be held at Bellagio, Italy, from September 4th to 24th.

By an oversight the name of Mr. DAVID MARTIN, O.B.E., M.I.E.E., past-president of the Association of Mining Electrical Engineers, was omitted from our last issue as one of those who entertained Mr. FRANK WHYSALL to dinner in Glasgow prior to his leaving for Belfast.

Sir OLIVER and Lady LODGE celebrated their golden wedding at Malvern on August 22nd.

Obituary.—MR. A. E. GIBBS.—The death occurred, from heart failure, on August 15th, of Mr. A. E. Gibbs, who was well known in the cable industry. Under Messrs. W. T. Glover & Co., he was responsible for the Manchester, Salford, and Johannesburg contracts, each of which ran into hundreds of thousands of pounds, besides many others of considerable size. He was also distribution engineer for the Johannesburg Municipality, for many years, and construction engineer for the Victoria Falls and Transvaal Power Co. until 1914. He had, more recently, been works manager to Messrs. Taskers, of Andover, and, at the time of his death, was representing certain manufacturers in the South of England. He leaves a widow and three children.

Wills.—The late Mr. BERTRAM R. BEALE, electrical engineer, Kensington, W., left £17,059.

Mr. W. M. ROGERSON, who was electrical engineer to the Halifax Corporation for 25 years, left £2,278 (net personalty £1,946).

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

E.M.D. Co., Ltd.—Private company. Registered August 19th. Capital, £100 in £1 shares. To acquire and exploit Patent No. 267,584 and applications Nos. 11,576-27 and 11,925/27 now vested in D. Suchostawer, H. V. N. Graveley, and A. A. Stubbs, and to carry on the business of manufacturers, importers, and exporters of and dealers in drawn wire, electric cabling, electric lamps, and all parts used in connection with electrical, telegraphic, telephonic, and wireless instruments, &c. The permanent directors are:—M. Suchostawer, 238, Portwall Road, W.9, electrical engineer; H. V. N. Graveley, 5, Golders Rise, Hendon, N.W.4, merchant; A. A. Stubbs, 47, Addison Avenue, Holland Park Avenue, W.11, secretary. Solicitors: Cochrane & Cripwell, Balfour House, 119, Finsbury Pavement, E.C.2. Registered office: 1-3, Sun Street, E.C.2.

Smoke Consumer and Coal Saver Co., Ltd.—Private company. Registered August 13th. Capital, £3,000 in £1 shares. Objects: To carry on the business of engineers, manufacturers and merchants of machinery, vehicles and engines, whether propelled or operated by petrol, steam, gas, electricity, or other means, &c. The first directors are:—Dr. J. C. McClure, 65, Wimpole Street, W.1, physician and surgeon (chairman); A. C. D. Hoare, 32, Gt. Smith Street, Westminster (director of McClure, Young & Co., Ltd.). Secretary: C. A. Dodds. Solicitors: Taylor & Osborn, Caversham Chambers, 226, Kentish Town Road, N.W.5. Registered office: 3, Copthall Buildings, Copthall Avenue, E.C.

Electrical Wiring Investment Co., Ltd.—Private company. Registered August 18th. Capital, £100 in £1 shares. Objects: To carry on the business of suppliers and vendors of electric light, heat and power installations, financiers by way of hire, hire-purchase or otherwise, &c. The first directors are:—P. V. Hunter, Springhurst, Addington, Surrey; E. Leete, Yew Bank, Wadhurst, Sussex; D. W. H. Murton-Neale, The White House, Hawkhurst, Kent. Solicitors: Murton, Clarke & Murton-Neale, Cranbook, Kent. Registered office: Hawkhurst, Kent.

Hart Bros. Electrical Manufacturing Co., Ltd.—Private company. Registered August 18th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric wire and cables, silk and cotton-covered wires, enamelled and resistance wires and flexibles, electricians, &c. The first directors are:—C. Hart, 63, Forest Road, Edmonton, N.9; J. Hart, 147, Masons Avenue, Wealdstone; B. Andrews, 49, Durants Road, Ponders End; and A. Hart, 41, Mandeville Road, Enfield Wash, electrical manufacturers; Annie L. Woolnough, "Lyonesse," Lyonsdown Road, New Barnet, school mistress; F. G. Purkiss, 45, Quernmore Road, N.4, accountant. Qualification, £100. Solicitors: Frank Simonds and Carter, 98, Salisbury House, E.C.2. Registered office: 4, Queensway, Ponders End.

Lowdon Bros. & Co., Ltd.—Private company. Registered in Edinburgh August 12th. Capital, £25,000 in 20,000 preference and 5,000 ordinary shares of £1 each. Objects: To acquire the business of electrical contractors, consulting electrical and general mechanical engineers, carried on by Lowdon Bros. & Co., at 37, North Tay Street, Dundee. The first directors are:—E. J. B. Lowdon, 1, Adelaide Terrace, Dundee, electrical engineer; D. H. Morris, 9, Dundee Road, Stannergate, Dundee, electrical engineer. Secretary: H. E. Vincent. Registered office: 37, North Tay Street, Dundee.

Thornthwaite Lighting Co., Ltd.—Private company. Registered August 18th. Capital, £3,000 in £1 shares. Objects: To carry on in Thornthwaite and Braithwaite, in the civil parish of Above Derwent, Cumberland, the business of an electric light company in all its branches. The permanent directors are:—A. Wilson, Thornthwaite Grange, Keswick, mining engineer; C. Wilson, 8, Charterhouse Street, E.C.1, diamond merchant. Solicitors: Arnold, Greenwood & Son, Kendal. Registered office: Thornthwaite, Keswick.

Edison Illuminating, Ltd.—Registered August 19th. Capital, £400 in £1 shares. Objects: To carry on the business of electricians, electrical and mechanical engineers, manufacturers of and dealers in electrical apparatus and appliances, &c. The subscribers (each with one share) are:—J. R. Beckensall, 29, Alwyne Villas, Canonbury, N.1; M. J. Lucey, 142, Old Ford Road, Victoria Park, E.2; and five other clerks. Solicitors: Mayo, Elder & Co., 10, Drapers Gardens, E.C.

S. E. McGowan & Co., Ltd.—Private company. Registered August 15th. Capital, £2,000 in £1 shares. To carry on the business of letters on hire of motor-cars, motor garage proprietors, motor and electrical engineers, dealers in electrical plant, fittings and accessories and motor-cars and accessories, &c. The first directors are:—S. E. McGowan, automobile engineer, Mrs. M. McGowan, W. Rayner, and Mrs. S. A. Rayner, all of 30, St. Annes Road, Blackpool.

Official Returns of Electrical Companies.

Multi-Way Earthing Clip, Ltd.—A. H. Partridge, of 3, Warwick Court, W.C.1, was appointed receiver on July 20th, 1927, under powers contained in debentures dated November 6th, 1924.

Westminster Engineering Co., Ltd.—Statement under Section 12 (old charges outstanding on July 1st, 1908, now first registered). Debentures authorised August 29th, and issued on various dates between November 7th and December 31st, 1900, securing £2,700.

Ripaults, Ltd.—Land Registry Charge on 1, 1a, 3 and 5, King's Road, and land and factory in rear and on side thereof, St. Pancras, dated July 29th, 1927, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Auto-Electric Advertising Co., Ltd.—Particulars filed of £40,000 debentures authorised July 6th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Regent Electrical Co., Ltd.—Debenture dated August 8th, 1927, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. McEwen, "The Knowe," Inverness.

New General Traction Co., Ltd.—Satisfaction in full on July 1st, 1926, of mortgage dated June 28th, 1901, securing £200,000. (Notice filed August 11th, 1927.)

General Battery Co., Ltd.—G. M. Chantrill, of 47, Campbell Road, Finsbury Park, N.4, was appointed receiver on May 10th, 1927, under powers contained in debenture dated November 29th, 1926. (Notice filed August 8th, 1927.)

Woodhall Wireless Manufacturing Co., Ltd.—F. W. Stephens, of 26-30, Salisbury House, E.C.2, ceased to act as receiver and manager on August 10th, 1927.

Silgolum, Ltd.—Particulars filed of £3,000 debentures authorised July 15th, 1927, charged on the company's assets, present and future, including uncalled capital, the amount of the present issue being £300.

Eagle Wireless Supply Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed June 2nd, 1927). 990 shares taken up. £990 paid. Mortgages and charges, nil.

Chagford and Devon Electric Light Co., Ltd.—R. Waycott, of Victoria Street, Paignton, appointed receiver by Order of Court dated August 11th, 1927.

City Notes.

German Companies.

The *Bank of Electrical Values*, Berlin, proposes to pay on the increased share capital a dividend of 10 per cent., as compared with 9 per cent. for 1925.

The directors of the *Electricity Company (late W. Lahmeyer and Co.)*, Frankfort-on-Main, state that a dividend of at least 9 per cent. will be proposed for the past year; this rate was paid for 1925.

The *United Electrotechnical Works (F. W. Busch and Jager Brothers)*, Ludenscheid, report net profits of 70,000 marks for 1926, which sum has been placed partly to the reserve fund and partly carried forward.

The *Robert Bosch Co.*, Stuttgart, reports a gross profit of £1,165,000 for the past financial year as compared with £1,645,000 in 1925. After making the necessary deductions and allowances for depreciation, &c., the balance sheet shows a loss of £42,800, as against a net profit of £175,000 in the preceding year.

International Light and Power Co.

The gross earnings of this company's subsidiaries for the year ended June 30th last amounted to £395,658, as compared with £389,169 in 1925-26. The net earnings were £6,058 higher at £94,990, and, after meeting debenture and note interest, sinking fund and preference dividends, a balance of £34,847 is available for depreciation, reserves and ordinary dividend.

Ernest F. Moy, Ltd.

The report for the year ended December 31st last shows a net profit of £812, subject to income-tax, and the directors recommend a dividend of 6 per cent. on both the preference and ordinary shares. During the year the existing first and second debentures (£7,450) were paid off and an issue of £6,000 of 7½ per cent. debentures was made.

Stock Exchange Notice.

The following have been ordered to be officially quoted:—North Metropolitan Electric Power Supply Co.—250,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 900,001 to 1,150,000.

Dorman, Long & Co., Ltd.

The directors have decided to pay the dividend on the 6 per cent. preference shares for the nine months ended March 31st last.

Pennsylvania Water and Power Co.

A dividend of 62½ cents per share has been declared on the common shares in respect of the quarter ending September 30th. The company proposes to acquire the Holtwood Power Co., a subsidiary organised by it in 1924. This will provide a steam reserve for the company's hydro-electric plant.

Aberdeen Suburban Tramways Co., Ltd.

The *Financial Times* reports that the company is about to be wound up. The last half-yearly accounts showed a loss of £1,189, but after crediting the amount brought forward there was a balance of £1,237.

Stewarts & Lloyds, Ltd.

An interim dividend at the rate of 10 per cent. per annum has been declared on the preferred ordinary shares, as in 1926.

Melbourne Electric Supply Co., Ltd.

The dividend on the 8 per cent. first cumulative preference shares for the half-year ending August 31st has been declared.

Adelaide Electric Supply Co., Ltd.

The dividend in respect of the half-year ending August 31st has been declared on the 6 per cent. cumulative preference shares.

Pinchin, Johnson & Co., Ltd.

An interim dividend of 10 per cent. (actual) has been declared on the increased ordinary capital, as in 1926.

Victoria Falls and Transvaal Power Co., Ltd.

The directors state that the net earnings for the quarter ended June 30th, before providing for taxation, were £260,760.

Stocks and Shares.

MONDAY EVENING.

BRAZILIAN Tractions have broken all their previous high records with a fresh rise that took the price to 178. This is the outstanding feature of strength in Stock Exchange markets that hold noticeable firmness so far as investment securities are concerned. Stocks in the list of British Government issues are a trifle dull because money became unexpectedly stiffer, but the gilt-edged descriptions amongst industrials are the reverse of dull.

London Power 5 per cent. debenture is better, if anything, at 98¼, and the County of London 5 per cent. debenture scrip holds its recent rise to 1¾ premium.

British Electric Traction ordinary stock has become divided into its two varieties: the 8 per cent. non-cumulative preferred stock is quoted at 119, and the deferred ordinary stock at 500 middle. Business has been done round about 486.

Stock v. Shares.

Gratifying as the price of the deferred must be to proprietors of the stock, it is not unlikely that some of them may be wishing that their security stood at a more marketable price than that represented by the Stock Exchange official quotation of 475 to 525. This apparently absurd margin of 50 points between selling and buying prices is, of course, nominal to a great extent: there is something much closer when one comes to deal. But conversion of £1 shares into £100 stock is a blow at the negotiability of the security. Trust companies regard stock as being a more dignified shape for their issues than shares are, but the holders are apt to protest—as a rule very quietly—at the sacrifice of marketability to respectability. The Globe Telegraph & Trust has resisted, so far, this predilection for stock, although it must be admitted that even shares may be none too easy to deal in at close margins when the nominal value of those shares is £10 each.

Another High Record.

As mentioned above, this week's rise, of 5 points, has lifted Brazilian Tractions to 178, the highest point so far reached. Incessant pressure from Brussels and Montreal, both of which centres have been accumulators of the shares for many months past, continues to be the main inspiration for the advance. It may be recalled that some time ago, rumour persisted in the idea that an influential Canadian group was intent upon obtaining control of the concern, but found opposition from another syndicate with a similar object. It would appear as though some element of truth lay in this report, for the long rise in the price has failed to bring many shares to market. Whatever supply the private holder has provided, this has been readily absorbed. The shares are probably held at the present time in fairly large blocks distributed over a narrow circle. The company is doing well, of course, and the recent raising of the dividend, from 4 per cent. to 6 per cent., is striking testimony to its prosperity, but at the current quotation the yield is barely 3½ per cent. on the money. Sidros, which are generally understood to have a considerable stake in Brazilian Tractions, have strengthened to 17¼. Renewed attention is directed to Perak River 7 per cent. participating debenture

stock at 96½, and to the shares, now up to 8s. 6d., by reason of the extension of electrical supply to some of the important tin-dredging companies in the F.M.S. Contracts in connection with these works have been placed with well-known English firms, and the development of electricity in the Middle East bids fair to prove a very useful adjunct to enterprises at home.

Intriguing Speculations.

The manufacturing companies' shares are steadily advancing in price. British Insulated, Callenders, Electric Construction and Siemens, are amongst those which show gains on the week. English Electric ordinary and preference have risen sharply. The inter-relation, lately announced, between British Insulated, Callender's, and Henley's, in the matter of experimental research, is held in some speculative quarters to be the herald to association, far more comprehensive and far-reaching, in this branch of electrical engineering industry. Modern tendencies bend strongly in the direction of amalgamations and agreements. Monopoly is not the aim so much as a more effective and efficient method of working. It may be years before the electrical manufacturing group will take steps to combine, but, as we have just hinted, the possibility of such cohesion is already canvassed, and is advanced as a serious reason why investors who already hold the shares should keep them, and why others may buy the shares, even at to-day's high prices, in the comfortable assurance of doing well with them in the course of time. The theory—and at present it is no more—offers an alluring theme for discussion.

Telephones.

British Aluminiums have strengthened to 48s. 9d. Telephone Manufacturing are good at 7s. 3d. In the wireless list, Marconi Marines are better at 27s. 6d. Canadian Marconis keep about 6s. 3d. Renewed support for United River Plate Telephones has raised the price to 10⅞. The natural inference, in view of the chairman's speech at the recent meeting, is that the buying may be connected with fresh endeavours on the part of American interests to acquire a preponderating influence in the undertaking. Radio Corporations are substantially better at 13¼. Automatic Telephones are unchanged at 46s. 3d.: International Automatics are better at 37s. 9d. Venezuela Telephones changed hands the other day at 25s. Bogota keep round about 32s. 3d., and the new shares, issued at 25s., and now 7s. paid, are quoted at 2s. 6d. premium.

The Electric Hare.

The principal Home Railway feature for the time being is the revival of interest in Metropolitan consolidated. While Districts lost 1¼ points, "Mets." rose to 56½. The buying that caused the advance is thought to be due to expectations of the company benefiting from the new sport of greyhound-racing if the Stadium at Wembley is employed for this purpose. The White City at Shepherd's Bush, where the racing is at present carried on, is served by the Central London Railway. Underground Electric Railways of London issues are quiet, but lively interest is taken in the adjourned meeting, to be held on Friday in this week, at which the directors will no doubt pass their scheme for altering the status of the company's 6 per cent. income bonds. It will be remembered that at the last meeting no quorum was available, but the chairman announced the decision of the directors to reduce to 21s. the price at which holders of the income bonds should have the right to convert into shares. Faint hopes are entertained that the conversion rights will be allowed to operate at £1.

Provincial Electricity Prices.

Edmundsons and Urbans are the firmest spots in the list of Home electricity supply companies. The first are 1/16 up, and Urbans gained half-a-crown. The market in both shares is hard, and there is not much stock to satisfy the demand. City Lights rose to 28s. 9d. Notting Hill preference have put on another ½, raising the price to 10½, and St. James' preference rose to 24s. 6d. Amongst provincial shares, Bournemouth and Poole have gone back to 57s. Richmond (Surrey) are quoted at 30s. Sevenoaks are 22s. Oxfords 28s., Newcastle and District 1/16 up, this week, at 22s. 6d., Llanelly and District 15s. 9d., Isle of Thanet 18s., Fife Tramway Light and Power 16s. 3d., North Wales Power 7s. 6d., and Chiswick Electricity Supply 52s. These prices are for the ordinary shares in all cases. In some of them, the market is somewhat limited.

London tramways shares are looking up. People want to buy London United ordinary, by way of giving option money, but there are not many shares about: the price is supposed to be a shilling. The preference have attracted buyers at the advanced price of 8s. 6d. London & Suburban Traction preference are up to 11s., and the ordinary put on 6d. at 3s. 3d. It is a long while since any of these shares received public notice: the market in them has been moribund for months past. Engineering, iron and steel shares, have been strong, but a slight reaction took place from the best in Vickers, taking them back from 12s. to 11s. 7½d. The rubber share market is firm, though business is by no means active.

Correction.

Owing to a printer's error the fifth paragraph on p. 316 of our last issue opened incorrectly. The first line should have read: "Telephone Manufacturing shares advanced to 7s. and held. . . ."

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Aug. 22 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	57/-	—1/-	4 18 8
Brompton Ordinary	£1	10	8⅝	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	8½	25/6	—	5 9 10
do. do. 4½ Pref.	£1	4½	4½	17/6	—	5 2 10
Chelsea	£1	12	8⅝	25/-	—	5 12 0
City of London	£1	15	10	28/9	+6d.	4 18 3
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Clyde Valley	£1	8	8	30/6	—	5 5 0
County of London	£1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	£1	8	10	35/-	+1/3	5 14 3
do. 7% Pref.	£1	6	7	24/6	—	5 14 3
Elec. Supply Corporation	£1	10	10	32/-	—	6 5 0
Kensington Ordinary	£1	15	8	25/6	—	5 9 10
Lancs. Light and Power	£1	7½	7½	26/-	—	5 15 5
London Electric	£1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	£1	6	6	5⅞	—	5 7 10
Metropolitan	£1	11	6	29/6	—	4 14 11
do. 4½% Pref.	£1	4½	4½	17/-	—	5 8 6
Midland Counties	£1	6½	6	21/6	—	5 11 7
Newcastle-on-Tyne Ordinary	£1	7	5	22/-	—	4 10 11
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	£10	6	6	10½	+⅛	5 14 3
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	8	25/6	—	5 9 10
South London	£1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	£1	7	7	1⅛	—	6 3 0
Urban Ordinary	£1	7	7	27/6	+2/6	5 1 10
do. 6% Pref.	£1	6	6	1⅛	—	5 13 0
Westminster Ordinary	£1	15	8½	25/-	—6d.	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	21/-	—	7 2 10
Yorkshire Elec.	£1	8	8	30/-	—	5 6 8
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	5	56½	+2	5 6 2
do. District	,,	3½	3½	63	—1	5 11 0
Underground Electric	£1	Nil	1½	19/-	—	1 11 5
do. do. Income	Bonds	6	6	103	—	*5 16 6
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	,,	1	8	10	46/8	—	4 6 8
Chili Telephone	,,	5	5	6	7⅞	—	3 1 3
Eastern Extension	,,	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	,,	Stock	10	10	178½	—	*5 12 1
Globe Tel. and T. Ord.	,,	10	10	10	18½	—	*5 7 5
do. do. Pref.	,,	10	6	6	11	—	5 8 1
Great Northern Tel.	,,	10	20	20	30½	—½	6 11 0
Indo-European	,,	25	8½	10	44½	—	*5 7 6
Marconi	£1	Nil	Nil	18/9	—	.. ...
Marconi-Marine	,,	1	7½	8½	27/6	+1/3	6 7 3
Oriental Telephone Ord.	,,	1	12	12	52/6	—	*4 9 4
United R. Plate Tel.	,,	5	8	8	10⅞	+⅜	3 17 1
Western Telegraph	,,	10	10	10	17⅝	+⅛	*5 13 6
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	8⅛	—1/16	8 0 0
do. do. 2nd Pref.	£5	6	6	8⅛	—1/16	8 14 6
do. do. 5% Deb.	Stock	5	5	72½	—	6 17 11
British Electric Traction Def. Ord.	,,	8	8	500	—	... ...
do. do. 8% Pref. Ord.	,,	6	8	120½	—	6 12 10
Brazil Traction	100	5	6	178	+5	3 6 6
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	6⅝	6½	129½	—	4 16 8
do. do. Deferred	,,	8	8	161	—	*4 19 5
do. do. Deb.	,,	4½	4½	83½	—	5 5 7
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	11/-	+2/9	Nil
London United Tram. Deb.	Stock	4	4	53½	—	7 19 5
Mexico Trams, 5% Bonds	—	5	5	74	—	6 15 2
Mexican Light Common	£100	Nil	Nil	40½	+1	Nil
do. Pref.	£100	Nil	Nil	73½	+2	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	£1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	£8	13	13	52/6	—	4 19 1
British Aluminium Ord.	£1	12½	10	48/9	+2/-	4 2 0
British Elec. Transformer Pref.	£1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	£1	15	15	3¼	+1/3	4 4 0
Brush Ord.	£1	10	10	26/3	—	7 12 4
Callenders	£1	15	15	3½	+1/16	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	16/-	—	... ...
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	88	—	5 13 8
Electric Construction	£1	10	7½	26/3	+1/3	5 14 3
Enfield Cable Pref.	£1	7½	7½	25/-	—	6 0 0
English Electric	£1	Nil	Nil	8/9	+9d.	... ...
do. do. Pref.	£1	3	—	15/-	+5/-	... ...
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	7½	7½	30/6	—	4 18 4
Henley	£20	25	25	95/-	—	5 5 3
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	5	5	18/9	—	*5 6 8
Johnson & Phillips	£1	17½	12½	48/9	—	5 2 8
Met.-Vickers Ord.	£1	8	8	36/9	—	5 19 8
do. Pref.	£2	8	8	2¾	—	6 14 9
Siemens Ord.	£1	7½	7½	26/6	+9d.	5 14 3
Telegraph Construction	£2	10	10	27½	—¼	*4 7 4

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during July, 1927.

OUR foreign trade did not bear so favourable an aspect in July as in the previous month, the exports showing a substantial decrease in comparison both with last June and with July, 1926. The decrease was spread over all but four items in each case.

Comparing the items with those of June, it will be observed that the greatest decrease occurred in the case of telegraph and telephone instruments and apparatus, which declined by over £87,000. Three other decreases amounted to well over £30,000, *viz.*, unenumerated goods and apparatus, "other" motors and generators, and non-submarine telegraph and telephone wires and cable. Glow lamps manifested the greatest proportional decrease—about a third. Only two of the increases were of any moment, a rise of £52,000 in unenumerated electrical machinery, and one of £17,000 in submarine telegraph and telephone cable. In the comparison with July, 1926, telegraph and telephone apparatus is again prominent as recording the largest fall. The next on the list was insulated wires and cables, exports of which declined by over £45,000. A drop of £40,000 in unenumerated electrical goods and apparatus was nearly balanced by a rise in exports of unenumerated machinery. The other increases were small. In spite of the lower exports during July, the seven months' total shows a satisfactory increase as compared with January-July, 1926.

Our exports of electrical machinery were distributed as follows; the July, 1926, equivalents are placed against the figures:—

Destination.	July, 1926. £	July, 1927. £	Inc. or dec. £
European countries	93,550	93,206	− 344
Japan	7,380	32,093	+24,713
South America	52,876	24,665	−28,211
South Africa	33,721	60,064	+26,343
British India	119,813	87,337	−32,476
Australia	81,467	149,819	+68,352
New Zealand	17,528	39,137	+21,609
Canada	28,347	12,187	−16,160
Other countries	93,640	44,904	−48,736
Totals	£528,322	£543,412	+£15,090

There was a small fall in the import total, but increases and decreases were almost equal in number and magnitude. The increase of nearly £20,000 in glow lamps is significant not only because it is the largest change, but because it coincides with a decline of similar proportions in the exports of these lamps. The largest decrease, as in the export list, occurred in telegraph and telephone instruments and apparatus. Comparison with the figures for July, 1926, shows a rise of over £53,000. The greatest increase was shown by unenumerated machinery, which occupied this position in the export list. There were also substantial rises in glow lamps and unenumerated electrical goods and apparatus.

In the re-export section the largest increase and decrease, as compared with June, practically cancelled one another out. There were three proportionately large falls in the comparison with July, 1926, and only one increase of any size.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for July, 1927.	Inc. or dec. as compared with June, 1927.	Inc. or dec. as compared with July, 1926.	Electrical imports for July, 1927.	Inc. or dec. as compared with June, 1927.	Inc. or dec. as compared with July, 1926.	Electrical re-exports for July, 1927.	Inc. or dec. as compared with June, 1927.	Inc. or dec. as compared with July, 1926.
Electrical goods and apparatus (unenumerated)	£165,048	− £37,574	− £39,987	£101,157	+ £8 137	+ £16.176	£4,727	+ £2,252	− £588
Insulated wires and cables ...	214,981	− 14,363	− 45 676	51,080	− 9.971	− 7,782	624	− 423	− 2 515
Glow lamps	42,488	− 22,022	− 7,611	43,714	+ 19 832	+ 25,163	1,946	+ 1.740	+ 1.627
Arc lamps and parts	1,092	− 343	+ 232	3,962	+ 1 544	+ 3,297	4	− 69	+ 1
Batteries and accumulators ...	119,768	+ 8,294	− 7,304	51 136	+ 4,513	− 2.344	981	+ 721	+ 686
Meters and instruments ...	30,857	+ 409	− 5 133	18,2 0	− 11,144	+ 240	733	+ 532	− 13
Carbons	996	− 463	− 102	11,884	+ 4,786	+ 6,387	62	+ 4	+ 47
Electrical Machinery—									
Electrical machinery (unenumerated)	343.981	+ 51,993	+ 39,258	134.738	− 5,085	+ 30.116	5,632	− 2 4.6	− 3,368
Railway and tramway motors	27 613	− 9.093	+ 2,557	—	—	—	—	—	—
Other motors and generators ...	171.818	− 35.096	− 26,725	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	3,976	− 1,368	− 3,921	29	− 16	+ 14	3	+ 3	+ 3
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	74.886	− 33.669	+ 3,831	4 919	− 7,642	− 5,984	160	+ 128	− 1,863
Submarine telegraph and telephone cable...	33.187	+ 16,921	− 1.734	—	—	− 5.500	—	—	—
Telegraph and telephone instruments and apparatus ...	190 822	− 87,621	− 106.611	25.421	− 10 572	− 6,610	2,962	− 482	− 818
Totals	£1,421,513	−£163.995	−£198 931	£446,300	− £5 618	+ £53,173	£17.834	+£1,980	−£7,801
Increases and decreases for seven months of 1927 ...		EXPORTS: + £1,191,137			IMPORTS: + £180,453			RE-EXPORTS: − £13.218	

Conditions in Rumania.

In a recent report to the Department of Overseas Trade (Stationery Office, 1s. net), Mr. R. J. E. Humphreys, Commercial Secretary to the British Legation at Bucarest, states that, owing largely to the good harvest, there was a noticeable improvement in economic conditions in Roumania during the past year. Transport and the leu exchange proved troublesome, but, in spite of these, there was definite progress. The United Kingdom's share of the import trade decreased on account of the coal dispute, but Rumanian exports to this country were greater, turning the scale in Rumania's favour. Success in the import trade depends upon finance and credit, especially as regards machinery of all descriptions. Germany, Austria, and Hungary give more favourable terms than British manufacturers, but payments are sometimes difficult to obtain. Mr. Humphreys says that as regards quality, Great Britain still holds its own, but more enterprise might be shown in examining the market personally and educating local merchants as to the merits of British goods.

An appendix to the report gives the number of generating sets in the country as 2,412, with an aggregate capacity of 231,433 kVA. Small d.c. sets appear to predominate in number, but the capacity of the a.c. plant is double that of d.c. plant. There are said to be 10,936 electric motors in use, with an aggregate of 184,279 h.p.

Electrical Imports of New Zealand.

THE following table shows the values of electrical and allied goods imported into New Zealand in 1926, according to the recently-issued official trade returns. The figures for 1925 have been given for purposes of comparison, and notes of increases or decreases added :—

	1925. Thous. £	1926. Thous. £	Inc. or dec. Thous. £
Electric batteries and cells—			
Total	85	126	+41
From United Kingdom ...	16	24	+ 8
,, United States	58	78	+20
,, Canada	7	22	+15
,, Denmark	1	1	—
Generators, motors and transformers—			
Total	540	564	+24
From United Kingdom ...	342	279	−63
,, United States	102	113	+11
,, Sweden	46	116	+70
,, Canada	15	17	+ 2
,, Belgium	8	7	− 1
,, Germany	—	14	+14
Insulated cable and wire—			
Total	613	571	−42
From United Kingdom ...	573	535	−38
,, United States	23	10	−13
,, Australia	3	1	− 2
,, Canada	11	11	—
Electric lamps (incandescent filament)—			
Total	128	151	+23
From United Kingdom ...	79	90	+11
,, Netherlands	30	31	+ 1
,, United States	11	15	+ 4
,, Austria	—	9	+ 9
Other electric lamps—			
Total	30	33	+ 3
From United Kingdom ...	6	6	—
,, United States	22	23	+ 1
Carbons in blocks, &c.—			
Total	50	29	−21
From United Kingdom ...	40	20	−20
,, United States	8	6	− 2
,, Australia	1	—	− 1
Cooking and heating appliances—			
Total	28	*	—
From United Kingdom ...	3	*	—
,, Canada	22	*	—
,, United States	2	*	—
Telegraph material and apparatus—			
Total	80		—
From United Kingdom ...	20	(See	—
,, United States	18	below.)	—
,, Belgium	36		—
Telephones and accessories—			
Total	102		—
From United Kingdom ...	6	(See	—
,, United States	24	below.)	—
,, Sweden	1		—
,, Belgium	65		—
Telegraph and telephone material—			
Total		296	—
From United Kingdom ...	(See	107	—
,, United States	above.)	156	—
,, Belgium		16	—
Other electrical material—			
Total	544	593	+49
From United Kingdom ...	335	318	−17
,, United States	140	158	+18
,, Australia	12	16	+ 4
,, Canada	44	80	+36
Electricity meters—			
Total	59	78	+19
From United Kingdom ...	55	76	+21
,, United States	2	1	− 1
Recording and testing instruments and meters—			
Total	84	87	+ 3
From United Kingdom ...	61	58	− 3
,, United States	15	20	+ 5
Steam engines, stationary, exceeding 200 b.h.p.—			
Total (mainly from United Kingdom)	5	3	− 2
Turbines, steam and water, and Pelton wheels, exceeding 200 b.h.p.—			
Total	18	31	+13
From United Kingdom ...	14	28	+14
,, Switzerland	3	—	− 3
,, Sweden	—	3	+ 3

* Not specified.

Conditions in Egypt.

Proposed Development of the Assuan Dam.

IN a recent report to the Department of Overseas Trade (Stationery Office, 2s. net), Mr. E. Homan Mulock states that, thanks to the recuperative power derived from the accumulated reserves of preceding years, Egypt is gradually emerging from the economic and commercial depression which characterised the greater part of the closing four months of 1926. Mr. Mulock says that if this depression preceded a return to normal conditions it was a blessing in disguise. He also considers that the purchasing power of the country has not been seriously affected. Imports declined during 1926 for various reasons, including the effect upon British imports of the coal dispute. The United Kingdom's share of the total fell from 25.2 to 21.8 per cent.

Electrical and Allied Imports.

The total imports of electrical machinery declined from £E165,354 in 1925 to £E152,424 in 1926. (The Egyptian £ is slightly more than the £ sterling). France remained the largest supplier with a decreased share of £E41,229. Germany wrested the second place from Great Britain, their respective totals being £E30,727 and £E20,555. The Allgemeine Elektricitäts Gesellschaft has established its own offices in Egypt, and has been under-quoting other German concerns for Government contracts. Italian, Belgian and Swiss competition increased during the year. There was a sharp fall in the imports of telegraph and telephone apparatus—from £E121,227 to £E30,400. The United Kingdom's share declined from £E92,429 to £E10,652, and that of Sweden from £E22,368 to £E17,810. Radio apparatus was classified separately for the first time in 1926, the total imports amounting to £E1,859, most of which came from France. Telegraph and telephone parts (including wireless) were valued at £E70,172, the United Kingdom providing £E34,592, and Sweden £E30,450. There were declines in the totals, and the United Kingdom's share of the imports of internal-combustion engines and power pumps.

Communications.

In September, 1926, an agreement was concluded between the Government and the Eastern Telegraph Co., whereby, *inter alia*, the royalties per word payable to the Government were doubled, while the company was given permission to lay five additional cables between Port Said and Alexandria. This has made it possible for the company to operate its regenerator system right through from London to Bombay and to accelerate telegraphic communication between England and Malta, Egypt and India. At the end of 1926 a commencement was made with the changing over of the Cairo telephone system to automatic working. In the meantime the provision of additional trunk facilities between Cairo and Alexandria has been still further delayed.

An agreement was made, in May, 1926, between the Government and Marconi's Wireless Telegraph Co., Ltd., whereby the latter was authorised to exploit for purposes of commercial radio-telegraphy the station at Abu Zabal, near Cairo, which is at present operated by the British Post Office. An Egyptian company was to be formed within six months, but there have been delays in connection with the securing of a suitable site for a receiving station.

Assuan Dam Power Scheme.

A debate took place in the Chamber of Deputies on February 14th, 1927, in which the Egyptian Government was urged to take definite steps, without any further delay, to ensure the completion at an early date of expert investigation of the possibilities of harnessing some of the water power made available by the Assuan Dam for the generation of electricity, to be used to drive pumps for irrigation purposes and for the fixation of nitrogen. This project was first mooted in 1912, and again came to the fore in 1921, since when it has lain dormant. The Minister of Public Works decided to invite a European expert to advise the Egyptian Government as to the best way of bringing this scheme to fruition, and to obtain opinions of experts in England and the United States through the medium of the respective Egyptian Legations.

Combines and Trusts in the Electrical Industry.

A Defence of British Manufacturers' Co-operation.

THE British Electrical and Allied Manufacturers' Association has produced a number of important studies of various phases of the electrical manufacturing industry, but none of them has been more opportune than the monograph on "Combines and Trusts in the Electrical Industry" which was to be published yesterday (184 pp.; 5 guineas net). This is really a monumental work representing an enormous amount of labour in collecting facts and statistics, sorting them out, and deducing their significance.

It is explained at the outset that it has been endeavoured to let the figures speak for themselves, a purely objective view having been taken. The compilers are not concerned "with the ethics of the 'ring' or 'combine,' since economic progress is something far removed from political rodomontade or civic sentimentality." It is clear that these last two factors, so prominent recently, have urged Beama into the production of this monograph of justification. The industry has suffered a great deal from misrepresentation which an exposition of the international situation will combat. It is claimed that by effective combination the British electrical industry has doubled the number of its employés in 14 years and kept them in steady work in the face of a severe trade depression. Moreover, the industry has secured the first place for this country in the exportation of electrical goods. In spite of this combination, Great Britain is still a long way behind its Continental competitors in the formation of rings and combines, and those who award British orders to foreign firms are placed in the illogical position of supporting far stronger trusts abroad, in an endeavour to break the British "ring."

Dealing with the broad subject of price stabilisation and co-operation in production, it is shown that industry must adapt itself to meet altering conditions, and principles of free trade and unrestricted competition, sound enough at one time, must inevitably be abandoned or modified. The expansion of the market following upon better conditions for large masses of people necessitated large scale production, accompanied by co-operation among manufacturers, price stabilisation, and control. In a number of the basic industries the amount of capital required rendered the large productive unit essential. It then became possible to increase output indefinitely until the market was "saturated," or only capable of expansion within small limits. The element of competition has much more importance in the case of such industries than in other industries where the demand can be rapidly stimulated, and, in the cause of self-preservation, the isolated large manufacturing unit has tended either to form amalgamations with other units in the same range of activity, or, failing this, to enter into negotiations with them with a view to determining standard prices and manufacturing specifications. In this Free Trade country the manufacturer could only rely for predominance on his technical ability or financial superiority, and when this position was practically lost by the advance in technical knowledge abroad, fostered by tariffs, the whole economic outlook was changed. Before the war a number of British industries had thus been stifled by foreign competition and the electrical industry itself was on the verge of bankruptcy. It was saved by the war, which created a need for the large productive unit, and it became clear that the future of the industry could only be assured by strong organisations, capable of meeting foreign competition and overcoming ruinous internecine competition.

Price fixation and control, however, which are maintained in almost every other national economic activity, without question, are still in a purely tentative stage in the electrical manufacturing industry. The electrical manufacturer knows that a real lowering of retail prices (of electrical energy) would mean a stimulation of the market and a broadening of the basis of production. The fact remains that the ultimate consumer seldom reaps the benefit of low manufacturing costs; it is absorbed wholly by the intermediary, who can force down the manufacturers' prices and keep up retail prices at the same time. It is a condition of economic prosperity that the producer, through better organisation, should be able to maintain a sound balance between manufacturing costs and selling prices. The placing of orders abroad has been ostensibly justified by the lower prices quoted, involving inferior material and wages below a bare subsistence minimum. A world level of prices is impossible, as it postulates not only standard designs, quality, material, and efficiency in operation, but also standard living conditions, identical wages, and an invariable level of efficiency in labour. Highly-efficient industries in this country cannot make good a difference in working costs, which may amount to over 30 per cent., without a direct attack on the wages and the standard of living of the worker. It is claimed that the final cost of a British engineering product, even if its initial cost is comparatively high, is distinctly lower than that of an imported product. "Price is not a matter of a sum placed on a tender form; it is the cost of an article as conceived in terms of efficiency, durability, and economy of design over a period of years, and by that test the British industry stands alone."

The monograph then proceeds to a general survey of what has already been done in the way of combination in the United States and Europe. Four principles are distinguished as forming the basis of these national and international combines. The first is the interlinking of finance with power supply on the one hand and electrical manufacture on the other—the financial groups being, as a rule, controlled by a manufacturing consortium or firm. The next is the elimination of competition in the home market by the absorption of competing firms by one powerful organisation or by the development of joint selling companies dealing with one range of products. Then there is the elaboration of price-fixing rings and sometimes of quota-fixing associations, either national or international—or both—whereby the firms retain their individuality but agree to standard prices and are allotted shares of the market. The last development is a combination of the foregoing three.

Practically without exception the electrical manufacturers of Europe and the United States fall into one of these four categories. The United States and Germany provide the most striking examples of the electrical manufacturer controlling power supply companies sufficiently to ensure a monopoly of their orders. The principle spread to other European countries, and in consequence a small number of manufacturers have so strengthened their hold on supply undertakings as to effectually close the market to foreigners.

The elimination of home competition is illustrated by the case of the German telegraph and telephone apparatus market, which is now covered entirely by the Siemens and Halske & C. Lorenz A.-G. working, with subsidiary companies, in close association. It is thought that in a short time the world market will be dominated by Siemens and Halske and the International Telegraph and Telephone Corporation working through its subsidiary, the International Standard Electrical Corporation. The International concern works in conjunction with the General Electric and Westinghouse Companies in America, and has attained a strong position by the formation of subsidiaries or co-operation with existing companies in France, Belgium, Spain, Italy, and Latin America. Competition in electric lamps has been virtually abolished by international agreement, and in Holland, Germany and France single companies control the market by arrangement. It is next shown how international agreements have practically eliminated genuine competition in Continental countries and how American capital has penetrated the European electrical industry. The monograph says: "It is only necessary for the General Electric, Westinghouse, Siemens-Schuckert, A.E.G., International Standard Electric Corporation, and the Brown, Boveri company to come together for competition to be largely eliminated in many markets of first-rate importance." The position in Japan is dealt with to show the strong position held by American companies in manufacturing and electricity supply. The tendency to concentrate exports in the hands of one or two concerns in each country is then illustrated. For instance, in both the United States and Germany the bulk of the business is carried on by three companies, and in Sweden the whole of the exports are made by the Allmänna Svenska A.B.

The monograph shows that the existence of a quota system with profit-pooling arrangements may render price-fixing unnecessary. A further development in concerted action has taken the form of a compensation fund. Firms nominated by the association bid very low prices in markets where foreign competition is dangerous; the competition is thus eliminated; and the firm's losses are made up from the fund. In Germany, France, Belgium, Holland, Switzerland, and Italy outside competition can be stifled by the raising of tariffs through the influence of the associations. In Germany and France cartels and syndicates control separate branches of production, and these are grouped together in a central body which co-ordinates general price policy, imposes standard conditions of contract, carries out any necessary political propaganda for the whole industry, and acts as an intermediary between the industry and the public. The price-fixing "ring" or association governing electrical manufacture in every European country which has an industry worthy of the name.

The most recent development is the association of the large combine with other combines at home and abroad. At present such operations are restricted to the United States, Germany, and, to some degree, Switzerland. Such a system will tend to eliminate competition in both the home market and internationally, and so ensure stability in trade conditions—"provided, of course, that manufacturers in Great Britain and France are also able to come together and

interpose for the industries in their respective countries combines sufficiently strong to balance similar combines in Germany and the United States." The present position is complicated, but it is maintained that any movements of importance which do take place will not aim at the restoration of the conditions of unrestricted competition, but at greater control of both production and price.

After dealing with the position as regards combines generally the monograph treats each of the principal countries in turn, commencing with Germany. In Germany, it is said, a spirit conducive to combination was manifested early; before the war practically every industry had its cartel or co-operative agreement, and these cartels received legislative sanction. To this elimination of uneconomic competition was attributed the prosperity of Germany right up to the war period, and on the whole the consumer did not suffer; there was never any outcry against "rings" as there has been in this country. The electrical manufacturing cartel was as strong as any before the war, and it still governs production and price policy. One central association, the Zentralverband der deutschen elektrotechnischen Industrie, decides general economic and manufacturing problems for the entire industry, and it represents the industry in the State Economic Council (the Reichswirtschaftsrat). Its main function lies in fixing standard prices, conditions of contract, and specifications; it is served by a number of groups dealing with different branches, and in some cases not only determines prices, but allocates orders. Consequently few contracts, large or small, are free from the direct or indirect control of the Association. Besides this body there are a number of cartels which deal specifically with articles lending themselves to quantity production and to division between producers on a quota system. Meters, cables and wires, insulators, heating and cooking apparatus, &c., are thus dealt with. The system has fostered the expansion of the large manufacturing groups, so that now three combines account for at least 70 per cent. of the national output. The monograph proceeds to describe in detail the associations of these groups with other industrial and financial concerns, and it is shown that the actual capital invested by these in electrical manufacture alone is over 520 million marks. This takes no consideration of allied activities. If note is taken of all capital engaged in production, distribution and sales, the real total amounts to almost 1,100 million marks.

In France the methods adopted resemble closely those employed in Germany, but in this case impulsion came from without, and the principal firms are subsidiaries of large American or Swiss groups. There is also a central French association of producers, the Syndicate Générale de la Construction Electrique, with similar functions to those exercised by the corresponding German body. It acts as a central bureau for co-ordinating policy among the various groups attached to it, for dealing with economic, commercial, and political problems bearing on the industry as a whole and, in certain cases, may carry out price- or quota-fixing operations where special contracts are under consideration. Separate groups control the production of various classes of goods, and there are also regional groups, the members of which also belong to the national organisations. In addition to this form of co-operation there has been a movement towards the amalgamation or close association of firms. The agreements between these firms are traced, particular reference is made to American, Belgian, and Swiss influences, and it is shown how competition has been virtually eliminated in a number of important directions. The view is taken that there are two dominating combines emerging—one the French Thomson-Houston group, backed by the General Electric Co. of America, and the other the Jeumont Company, with interests in Belgium, which may eventually amalgamate.

The connection between manufacture and finance in Belgium is even stronger than in France and Germany, and is on the whole a comparatively recent development engendered by the large part played by electricity in the reconstruction of the country. Brussels has become an international electrical financial centre and the Belgian power finance corporations have close enough associations with manufacturing concerns to enable the latter to enjoy a preference if not a monopoly of the orders controlled by the corporations. There are three principal electrical manufacturing firms, but these are practically controlled by foreign groups—mainly American.

In Switzerland, special conditions have emphasised the need not only for efficiency in production and a high standard of electrical design, but also for exact control of finance and the exploitation of all the resources which finance and administrative ability could command. The home market is so restricted, under normal conditions, that a large manufacturing concern could only be justified if it had a monopoly of the entire market and a steady demand from foreign countries for its basic products. Thus the Swiss manufacturing firms, if they were to justify the capital expenditure necessary for production on a scale to meet modern super-power projects, were forced either to combine into one trust or to develop an enormous export business, or both. Until recently combination was avoided and an effort was made to penetrate export markets even at a heavy loss. The State Railway electrification orders brought the manufacturers together, with a view to the elimination of competition and the maintenance of high prices, with the result that a price-fixing cartel exists in reality if not in name, while the quota system has been in operation on many occasions. The Brown-Boveri concern is the most powerful; it has subsidiaries in France, Germany, Italy, Austria, and the United States, and through its finance associations it has interests in over fifty electricity supply undertakings in 15 countries. It appears probable that eventually the Brown-Boveri concern will arrange a definite community of interests with the Siemens-Schuckert Co. or the A.E.G., with an American association in the General Electric Co.

In Italy, the Tecnomasio Italiano Brown-Boveri and the Cia. Generale di Elettricità cover more than 60 per cent. of the Italian demand. The Brown-Boveri undertaking, through its chairman, is linked up with the Edison and Conti electricity supply interests, which are sufficient to keep the firm fairly active. The position of the latter may be weakened by the strengthening of the Cia. Generale through the agency of the International Securities Corporation, which is controlled by the American General Electric Co. The situation in Italy is complex; there are a great number of small producers and subsidiaries of foreign firms.

Four firms supply the Austrian market, and these have worked in close co-operation in dealing with the important contracts placed by the State for main-line electrification. In general, Germany has been the model in organisation and price fixing. Hungary and Czecho-Slovakia are briefly mentioned, and the monograph next deals with Sweden. It shows that the A.S.E.A. is responsible for almost 60 per cent. of the national electrical production and has embarked upon a policy of expansion abroad. With six other firms, the A.S.E.A. forms the Sveriges Elektroindustriförening, which fixes prices and imposes standard conditions.

A section deals with power finance corporations, and it is pointed out that manufacturing concerns had to finance new power undertakings because, generally speaking, banks would only support projects with a long dividend-earning past. The conditions are now somewhat changed, however, and money for power development can be obtained in an easier manner. The methods of financial penetration carried out are dealt with: these are given as interlocking directorates; administrative or technical control by the holding of the bulk of the ordinary capital, directly or through a subsidiary; direct technical control by means of financial corporations, associated with electrical manufacturers, acting as consulting engineers; and the linking-up of manufacturing and supply undertakings through banks. The ways in which these methods have been applied in practice are discussed at some length, and then special reference is made to the countries concerned. Space does not permit a complete review of the ramifications exposed, but we may say that the investigation is thorough.

Industrial banks form the subject of the next division, and here, again, after discussing general principles, the monograph treats of the position in Germany, France, Belgium, and Switzerland, and illustrates the way in which the allocation of important orders is influenced by the financiers.

The final section deals with the movement towards international trusts. The authors claim to have shown that the modern tendency is for the trust to bring as many firms as possible into its system, allow the Central Association to combine the remaining producers, and so effect unity of policy and action. The moral is drawn that the British electrical industry must either form closer associations with German and American manufacturing concerns and so be absorbed in the ultimate international combine; or tighten up its own organisation, form a compact group of manufacturers with a common policy, both in manufacture (prices and orders), and in finance, and at the same time strengthen the Central Association. It cannot continue in the present system and remain in existence. Far more effective combination is essential to meet the competition of international groups: "The future prosperity of the industry is sufficient justification for close co-operation in prices and in manufacturing and marketing conditions. On a conservative estimate, the industry has not more than two years in which to effect the necessary changes before the testing period will come. It is not a question of technical but of administrative efficiency." With regard to power finance, it is considered that existing organisations in this country, where foreign controlling interests do not dominate policy, are inadequate, and efforts should be made to develop large-scale power finance groups capable of dealing with super-power schemes in any market. The only alternative lies in closer association between British manufacturers and the powerful organisation already operating in Belgium, and, possibly, the United States. This would not be of much value to the British manufacturer unless he was prepared to form an international electrical manufacturing cartel. It is probable, however, that a simple international price-fixing agreement would be more successful. After mentioning the way in which markets are closed to the British electrical manufacturer by the co-operation of foreign financiers and manufacturers, and the operations of electrical banks, the monograph avers that financial policy in this country has been a serious obstacle in the way of expansion of exports by basic industries. "Our competitors are directly and indirectly subsidised from London, and it is useless to brand our industries with inefficiency as an explanation of their depressed condition while financial policy runs counter to their interests." The suggested remedy is the development of power finance corporations and large industrial credit institutions.

The remainder of the volume sets out in full the statistics upon which the monograph is based. These indicate the magnitude of the foreign electrical trusts, their spheres of influence, and their international ramifications, and are worthy of the serious consideration of all students of the subject.

Almeida "Neutral System" Accumulators.

An account of a storage battery of Spanish origin, for which remarkable properties are claimed. The Editors take no responsibility for the validity of the statements which are here quoted.

BEHIND the bald announcement in one of our July issues of the formation of a British company with a capital of £34,500 and the title Almeida Accumulators, Ltd., there is the beginning of a new departure which may, or may not, prove to have an important bearing on the future of the accumulator industry, not only in this country but throughout the world. The announcement referred to merely stated that "the objects are to acquire any invention relating to the manufacture, application, and use of electric power accumulators, and to adopt an agreement with H. A. Miller."

Ever since the introduction of the lead-acid type of secondary battery, scientists and technical experts in all parts of the world have spared no efforts in an endeavour to produce an accumulator which, while possessing all the advantages and merits of the familiar type, shall be free from its drawback in the way of weight, the field of application for a high-capacity, lightweight battery being of course enormous. Moreover, during the past twenty-five years many experimenters have made it known to the public that success had at last attended their efforts and that the long-awaited "revolutionising" accumulator had arrived. Unfortunately, however, self-convinced of the merits of their production may have been the inventors, none of their ideas have survived the arduous tests of practical use, the result being that with the single exception of the Edison nickel-steel accumulator, the predominance of the lead-acid type of storage battery remains unchallenged.

The formation of Almeida Accumulators, Ltd., has, however, brought to light the fact that a new aspirant in the field of producers of "revolutionising" accumulators has recently entered upon the scene and that from an entirely unexpected quarter, the invention of what he terms "the neutral system of accumulators" being due to Father Edmundo Almeida, a member of the Spanish Jesuit fraternity.

Our attention was first attracted to the matter by a notice in our Spanish contemporary, *La Energia Electrica*, which in a short article mentioned that "Father Edmundo Almeida, of the Compania de Jesus, has invented a new type of electrical accumulator, which has met with a favourable reception in industrial circles, both Spanish and foreign. The new accumulator is quite different from all hitherto known types, it being neither of the acid nor the alkaline type. The characteristic feature is that in place of either of these, a solution of zinc chloride and other neutral salts is used. The negative plate is entirely metallic, without covering of any kind. The positive is formed of an 'unattackable' conductor with which is incorporated a small percentage of silver so finely divided up that it assumes a spongy character and acts as a catalyser.

"The advantages claimed for the new accumulator may be summarised as follows: The capacity is ten times greater than that of a battery of the A.F.A. (Accumulatoren Fabrik Gesellschaft, Berlin), for equal weight. The best of the tests have shown it to be capable of giving on discharge nearly 100 per cent. of the charge, the output of energy being approximately 93 per cent. Even when not in use there is, as in others, no spontaneous discharge. The voltage is 2.2 V with a notable equality between charging and discharge. The cell can be quickly charged and can be completely discharged, even by short-circuiting, without danger of damage. It can be left unattended indefinitely, a great advantage over the customary type, which requires charging from time to time even when not in use. No 'forming' period is necessary, it being possible to charge a new battery immediately it is turned out at the factory.

"Finally, the weight of the cell is only one-sixth or one-seventh that of the usual variety, an Almeida accumulator which weighs only 4.4 lb. and occupies a volume of 9¼ cu. in., being able to deliver 100 amperes for one hour or 10 amperes for ten hours. The accumulator has already been tested in Berlin by the above-mentioned company, one of the principal accumulator concerns in Europe, which, as the result of the opinion expressed by Prof. Donath, that the accumulator promised to create a revolution in the electrical world, established a special laboratory at its works at Hagen. Later the Schneider Co. of Paris became interested in the invention, and not only carried out tests in its own works at Champagne-sur-Seine, but caused independent tests to be conducted at the Laboratoire Central d'Electricité, in Paris, through all of which the battery came with satisfactory results, so much so that the Schneider Co. has secured the rights in the battery for France and the French Colonies and Protectorates, and that an international financial syndicate has also been formed to acquire the rights for the whole world, with the exception of France and Spain. The accumulator, in the opinion of a number of French technicians, will solve many problems, especially those in connection with electric rail and road traction."

Following the foregoing brief account of the Almeida accumulator, our Spanish contemporary returned to the subject at greater length in a subsequent issue. Thus we read that "it was while the Jesuit father was continuing his theological studies at Valkenburg, near Leyden, in Holland, in October, 1920, there suddenly came to his mind the idea of studying the reactions which, from the thermodynamic point of view, might form the groundwork for an accumulator having a greater capacity than those in ordinary use. Returning to Spain, his first experiments were made at the Jesuit Maxima College at Ona in the province of Burgos, where, although the results obtained confirmed the inventor's ideas on the subject, certain complications and difficulties were experienced which caused him to doubt whether he should continue or abandon his experiments. However, encouraged by the Count de Mieres, the owner of important mines in the Spanish province of that name, and others, he continued to develop his idea in a private laboratory in Madrid. Such good progress was made that in November, 1925, he proceeded to Berlin with a letter of introduction, obtained through the influence of Count Mieres, from the Spanish branch of the A.E.G. Co., to the Accumulatoren Fabrik Gesellschaft, the introductory letter being couched in cautious terms and merely asking the A.F.A. to give all consideration to Father Almeida's accumulator."

Our contemporary continues: "After leaving his papers with the Company he was, notwithstanding that the firm itself was spending a considerable amount of money in accumulator research work, and he only a Latin inventor entirely unknown to it, given a warm welcome by the managing director of the A.F.A. concern, which eventually arranged for the inventor to continue his experiments at its works and at its expense. It would appear that the tests, carried out with accumulators constructed in Madrid, gave excellent results, so much so that the A.F.A. desired to take over the rights for the whole world. As, however, the Company and the inventor could not agree as to the terms, the negotiations were broken off and Father Almeida went to Paris, where he continued his tests with the Schneider Co., with the results we have already recorded."

The *Elektrotechnische Zeitschrift* (E.T.Z.), of Berlin, in its issue of June 30th last, refers to the subject of the Almeida accumulator in the following terms: "Just recently, both in the German and foreign Press, there have been many references to the accumulator invented by Father Almeida. The accumulator in question has a positive electrode of carbon or graphite with an addition of silver, a negative plate of zinc, and as electrolyte a mixture of zinc bromide and zinc chloride. Such a form of accumulator has often been proposed, one example being given by Jumau in his work on 'Les Accumulateurs Electriques,' published in Paris in 1907. As, in the recent references to the Almeida battery, it is stated that satisfactory results had been secured in tests carried out by the Accumulatoren Fabrik Gesellschaft at its works both at Hagen and Berlin, we approached the company for particulars, in reply to which we received the following communication:—

"'It is quite true that, following its usual plan of looking into anything new that may be brought to its notice, the Accumulatoren Fabrik Gesellschaft has tested the Almeida accumulator both in the presence and under the direction of the inventor. Following a period of exhaustive tests extending for about six months, it had to come to the decision not to proceed with further tests, as it had come to the conclusion that no economical results could thereby be secured. According to the newspaper accounts, the Almeida accumulator has a capacity, for an equal weight, ten times greater than that obtained in practice from the accumulators so far in use. As against that, the above-mentioned exhaustive and most carefully conducted tests have conclusively shown that the practical utilisable storage capabilities of the Almeida battery, in relation to its weight, are considerably less than are obtainable from the lightly-built lead and alkaline accumulators which are to-day standard practice for special purposes. The same remark applies to the degree of activity. Father Almeida during the test period did not succeed in producing a battery which possessed an adequate length of life. None of the numerous cells produced in accordance with his instructions succeeded in fulfilling requirements in this respect. Finally, an important matter in leading to the decision not to continue the experiments was that it was not possible during the charging of the accumulators to prevent the giving-off of bromide and chloride vapours highly injurious to health. In discon-

tinuing the experiments the A.F.A. informed Father Almeida that so soon as he had overcome the difficulties with regard to output capacity and the emission of vapours dangerous to health it was prepared to go further into the matter. So far, however, no further communication has been received from him.' "

Some general information regarding his invention was given by Father Almeida at the recent congress in Cadiz of the Spanish Association for the Advancement of Science, while at a later gathering in San Sebastian at which 4,000 people are reported to have been present, he dealt at some length with some of the disadvantages which had been alleged against his accumulator. As for the rumours which had gained currency that fumes were given off during the charging operation, which were likely to cause injury to those engaged in the handling of the cells, he denied the existence of any such noxious gases. As regarded the question of cost, he asserted that for an equal capacity, this should be only about half that of ordinary cells.

Father Almeida was born in Salamanca in 1893, and is, therefore, at the age of 34 years, still a comparatively young man. At the age of 15 years he entered the Novitiate de Carrion de los Condes in the Spanish province of Palencia. Later he studied Humanities and Rhetorics at Burgos and Philosophy and the Sciences at the Colego Maxima, Ona, subsequently taking up an appointment as Professor of Physics and Chemistry in Vigo. In a final comment on his invention, Senor E. Gallego, in the Spanish contemporary already referred to, remarks that " all who are able to appreciate his high culture and his conscientiousness and persistent labour, find it difficult to doubt that he has devised an accumulator battery which shows a distinct advance in the field of electric accumulators."

A search at the British Patent Office reveals that while a patent relating to dynamometers was granted to Father Almeida as long ago as October, 1919, no British patent has so far been granted in respect of the new accumulator. Three applications for such patents were filed on July 13th last—two by Almeida Accumulators, Ltd., and one conjointly by Father E. Almeida and the British company, so that some time must elapse before any information is available as to the details of the new accumulator from this source.

When the British company was first registered, no names of directors were given, but a subsequent Somerset House entry records these as being Sir Arthur Ducros, president of the Dunlop Rubber Co., Ltd.; Mr. Walter Rutherford, a director of the Foundation Co., Ltd.; Mr. Edmund Spyer, of Beechams Estates & Pills, Ltd.; Mr. David Currie, of G. A. Peters, Ltd.; and Mr. H. Allan Miller, banker, of 485, Park Avenue, New York, the last-named being, apparently, with M. André Le Clercq, of Paris, connected with the financial syndicate known as the Compagnie Internationale des Accumulators Almeida already referred to as having secured the patent rights for North America, Great Britain, Canada, and Italy. As for Spain, it is stated that Father Almeida has retained the rights for that country, in order that a purely Spanish company may be organised for the manufacture and sale of the accumulators in Spain.

Wireless Auto-Alarm Devices.

Some details of new apparatus designed for the automatic reception of radio-telegraph signals from ships in distress at sea.

THE use on board ship of an alarm device for automatically responding to a special signal sent by ships at sea when in distress is provided for in the Merchant Shipping (Wireless Telegraphy) Rules recently issued by the Board of Trade. This important development in the use of wireless telegraphy at sea is the result of investigations commenced in 1923 by the Admiralty on behalf of the Board of Trade and the General Post Office, with the object of determining the possibility of designing an instrument capable of responding to a special signal used as the forerunner of the distress (S O S) call, and so making it unnecessary for ships' telegraphists to maintain continuous watch.

Several manufacturers have evolved apparatus which complies with the Government requirements of Statutory Rules and Orders, 1927, No. 529, and the engineer-in-chief (Radio Section) of the General Post Office has issued official notification that the gear described hereunder has satisfactorily passed all the required tests and has been approved for installation on board ships. It was specified that the alarm devices must respond to signals of no greater accuracy than is possible with hand transmission, with the aid of an ordinary watch possessing a seconds hand. Should the time sequence of the distress signal not be correct, the alarm must reset itself; the receiver must be independent of the ship's main telegraph receiver.

The trials showed the most suitable form of signal to consist of a series of four-second dashes separated by intervals of one second, as such a signal appears to be immune from interference by other wireless signals and atmospherics. When three four-second dashes have been received by the auto alarm device its mechanism is set in operation and rings bells in various parts of the ship, enabling the operator to resume duty in time to receive the actual distress message (which will follow the alarm) giving the position of the calling ship and particulars of its requirements. Class I ships (carrying 200 passengers or more, and engaged in other than coastal trade) at present carry three operators, who keep continuous watch; Class II ships (carrying between 50 and 200 persons, and ships engaged in coastal trade carrying 50 persons or more) carry only one operator and two wireless watchers; and Class III ships (carrying less than 50 persons) only one operator. The new rules stipulate that within twelve months all Class II ships shall be fitted with auto-alarm apparatus, unless the duration of the voyage does not exceed eight hours from port to port, and the employment of watchers can therefore be discontinued; Class I ships will be allowed to dispense with one of the three operators now required if an auto-alarm device is employed.

The Marconi Auto-Alarm.

The instrument made by the Marconi International Marine Communication Co., Ltd. (fig. 1) is intended to be connected directly to the ship's aerial when the telegraphist goes off watch. It consists of two parts:—(*a*) The receiver, which combines a three-valve amplifier and tuning circuits arranged so as to eliminate so far as is possible signals on wave-lengths other than 600 metres, and at the same time to be fully sensitive to any within 2½ per cent. of 600 metres, the limits of error which are now allowed in the tuning of ships' transmitting instruments. (*b*) The selector, to which the signals from the receiver are passed; its duty is to pick out the alarm signal from all other signals, or mixture of signals,

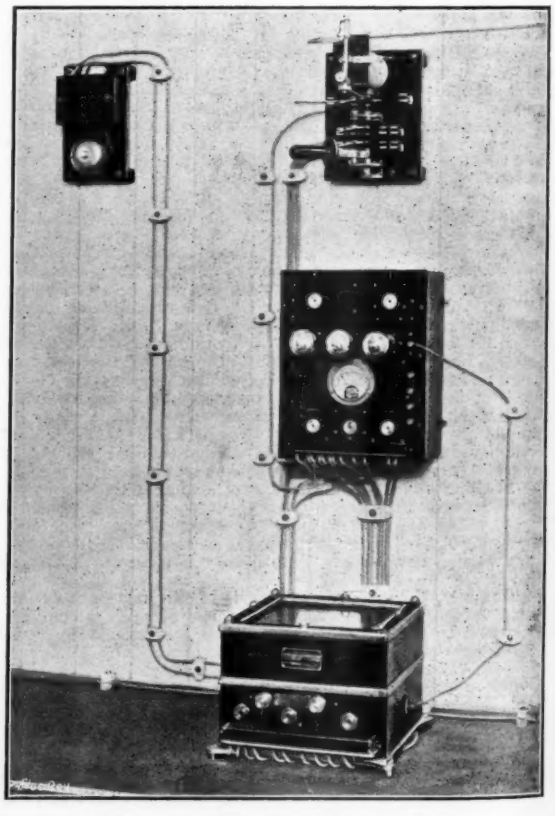


Fig. 1.—Marconi Ship's Auto-Alarm Installation.

which may be received. Experience has shown that if the device is set to operate at the termination of the third dash, a sufficient degree of security against false calls is obtained without jeopardising the chance of successful working through heavy interference or atmospherics. The movements of the selector are ingenious, and provide for the following :—

(i) It will accept a dash as being intended to have a duration of four seconds if it does in fact continue for more than three seconds and less than five seconds. (ii) It will accept a space as being intended to have a duration of one second if it does in fact continue for more than one-fifth of a second and less than two seconds. (iii) It will operate at the end of the third consecutive dash that it accepts, provided that it has also accepted the intervening spaces. (iv) It judges each dash and each space on its own merits; so long as the limits mentioned above are not exceeded, it does not matter if all the times are too long, or all too short, or if long and short times are jumbled up together.

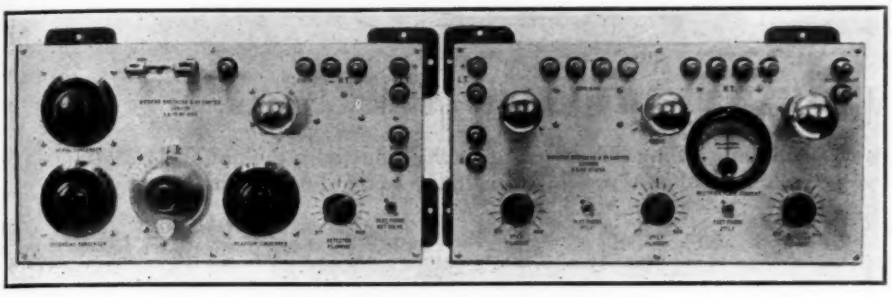


Fig. 2.—The Siemens Ship's Alarm Panels.

The timing of the various movements is controlled by the delayed movement of air dash-pots working against springs. The timing can be corrected, if necessary, without opening the case of the selector, the correction being made by altering the tension of the springs. It is arranged so that it cannot mistake a burst of very fast Morse for a continuous dash. Any space that is audible is sufficient to stop the movement caused by the receipt of a continuous dash, and this movement cannot recommence until the mechanism has returned to its starting point.

The peculiar arrangement of the selector, combined with the nature of the alarm signal, enables the apparatus to pick out the alarm signal even when two ships are sending Morse messages at the same time and on the same wave-length, however close they may be. Such a degree of interference does not hamper the working of the instrument, and trial has shown that if the alarm signal is continued for one minute, the apparatus will almost always respond to it even when three ships are working ordinary Morse on the same wave-length in the vicinity. The large tolerances mentioned above make it quite easy to send the alarm signal with sufficient accuracy by hand.

The Siemens Apparatus.

Designed to comply with the draft British technical wireless regulations of the Committee of Imperial Defence, the outfit manufactured by Siemens Brothers & Co., Ltd., comprises :—

(*a*) A tuner and single-valve detector circuit, so adjusted that it will respond to signals on wave-lengths between 585 and 615 metres, having a steady note frequency of not less than 100 per second when the strength of signals after the valve is such as to be just comfortably audible to the trained ear. The instrument is mounted in a cast metal box with metal panel; these features not only facilitate robust construction, but also ensure that the instrument is thoroughly screened and its selectivity consequently of a high order.

(*b*) A two-valve amplifier for the signals received on (*a*) and a single-valve for rectifying the signals before passing them on to the relay of the selector. This instrument matches (*a*) in that it is mounted in a cast metal box with metal panel, and the plate current of its rectifier valve is indicated by a milliammeter connected permanently in the circuit, which enables the change of plate current for various signals to be noted at once, and is of value for control purposes. Items (*a*) and (*b*) are shown in fig. 2. Sockets are provided after the first detector and the first and second amplifying valves to enable the instrument to be tested with head telephones.

(*c*) A selector, which consists of a wheel mounted on a shaft, which is engaged on a steady-running motor when a signal is received; contact mechanism bears upon the rotating wheel and, if the signal received is the alarm signal, a series of contacts is made which automatically causes a bell to ring. If, however, the signal received is not the alarm signal, the contacts will not be made, and by means of an ingenious releasing arrangement the whole of the mechanism is declutched from the motor and returns to the position of rest.

The bell will continue to ring until a switch in the wireless cabin is opened; also it will ring if any one of the valves in the receiver should break down. A buzzer is provided by means of which the installation can be tested as a whole (*i.e.*, from the aerial to the bell) in one operation.

The "R.C.C." Equipment.

The apparatus designed by the Radio Communication Co., Ltd., includes :—(*a*) A receiver (fig. 3) which will respond to any wave-length between 585 and 615 metres; a variable condenser is provided for tuning the aerial circuit, while the secondary circuit has fixed tuning and coupling. It employs three valves, the first being a detector, followed by two transformer-coupled low-frequency stages. The low-frequency signal is rectified by the last valve to give direct-current pulses for operating the input relay of the selector. The current from the anode circuit of the last valve is indicated by a milliammeter, and its mean value is adjustable by means of a grid potentiometer. A telephone jack after the first valve enables the receiver to be adjusted. All the valve filaments are connected in series, together with the winding of a relay; should one of the valve filaments fail, this relay will operate alarm bells continuously until the valve has been replaced. A test buzzer is fitted.

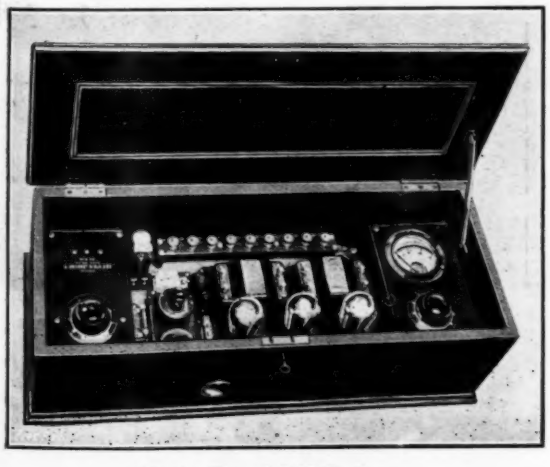


Fig. 3.—The "R.C.C." Receiver.

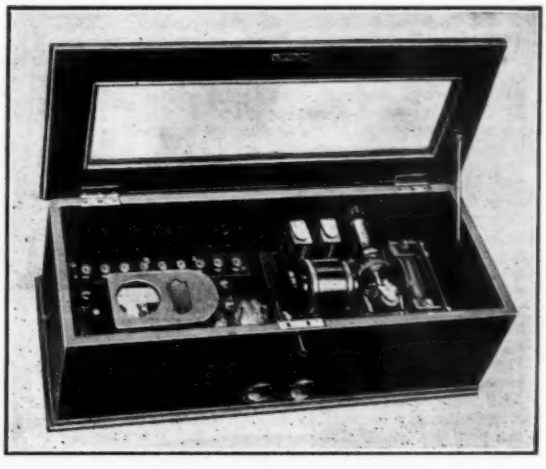


Fig. 4.—The "R.C.C." Selector.

(*b*) The selector is illustrated in fig. 4. At the left of the instrument is the enclosed polarised input relay operated by the output from the amplifier. The mechanism comprises two relays, a magnetic clutch, and a series of contacts operated

by means of a contact cam, driven through the intermediary of the magnetic clutch and speed reduction gearing by a simple motor of the synchronous attraction type with a single non-rotating winding. The motor is driven by an electrically-maintained tuning fork at the right of the case, which ensures a constant speed.

The rotating parts of the selector are all slow moving, so that they will run for very long periods with the minimum of attention. The current taken by the selector is only 0.25 ampere from a 12-volt battery, and the total current consumption for both receiver and selector is of the order of 0.6 ampere.

The standard of timing is obtained from a low-frequency tuning fork arranged to drive the synchronous motor in such a way that the speed of the latter depends entirely upon the rate of vibration of the fork. The motor, in turn operating through 50 to 1 reduction gearing and a clutch, drives a cam having a number of timing contacts and a bell contact; the cam moves away from a stop against the action of a spring. The clutch is magnetically operated and interconnected with the timing contacts, so that it grips continuously only when the alarm signal is received; hence, only under this condition can the cam rotate far enough to close the bell contact.

In an emergency the alarm signal would undoubtedly be sent more than once, but even without any repetition, and in the English Channel (where wireless traffic is particularly congested), it has been found during extended official trials that the bell rings over 95 times for every 100 alarm signals sent.

"Mazda" Lamps in the Making.

The B.T.-H. Company's methods of manufacturing electric lamps with the aid of a glass bulb-blowing machine which is capable of producing as many as 55,000 good bulbs per day.

THE average purchaser of an electric lamp seldom gives a passing thought to the number and complexity of the manufacturing processes involved in the production of this apparently simple article.

The glass portions of "Mazda" lamps are made in the Chesterfield works of the British Thomson-Houston Co., Ltd., and then dispatched to its Rugby works, where the various other stages of manufacture are carried out. The raw materials employed in the manufacture of soda-lime glass are British, and the mixing is done on the premises at Chesterfield. The bulbs are made by an automatic machine (except when a small quantity only of special bulbs is required, in which case they are made by hand) having an output of no less than 55,000 good bulbs per day of 24 hours. The machine, fig. 1, consists of a central column about which rotate twelve heads, the timing and operation of the various movements being effected by cams, rollers, &c.; it should be noted that two bulbs are made simultaneously on each head, and that the machine is situated alongside the glass furnace.

Each head carries two sets of moulds, but each set forms part of a separate productive unit, and can be adjusted independently of the other twenty-three sets of moulds. Blank moulds are mounted near the top of the machine at the ends of hollow arms which are set at an angle from the horizontal. As the machine rotates the arms come into position opposite the opening in the furnace and then move outwards, the moulds eventually coming into contact with the surface of molten glass in the gathering boot of the furnace; at that moment a vacuum valve opens and a charge of molten glass is sucked into each mould; the arm is then withdrawn, the surplus glass at the bottom of the mould being severed by means of oscillating knives mounted on the arms. The time taken to perform the entire gathering operation is approximately 1.5 seconds.

Another pair of arms, rotating about a longitudinal axis, is now in a vertical position immediately under the blank moulds with their charge of glass. On the upper end of these arms are mounted other moulds, or neck rings, to which the glass is transferred on the opening of the blank moulds and the releasing of the vacuum. The arms are hollow and carry plungers for indenting the pieces of molten glass immediately they are delivered to the neck rings, after which the plungers are withdrawn and compressed air is admitted to the cavities just formed, thus commencing the actual blowing of the bulb. The arms rotate about their own axis until the embryo bulbs are hanging vertically, in which position they are allowed to stretch a little, due to their own weight, after which finishing moulds close round them, compressed air being again admitted in order to blow the bulbs to finished shape. During these operations the head of the machine has been slowly rotating round the central column, and when the blown bulbs arrive in front of a small conveyor the finishing moulds and neck rings open and the bulbs are discharged, the moulds being automatically dipped into a water trough ready to repeat the series of operations just described. The bulbs conveyed to the "burning off" machine are picked up by a rotating star-wheel, from which they are delivered to revolving holders; whilst being rotated a series of small high-pressure gas jets impinge on the glass neck, which is melted so that the surplus portion falls off, leaving a smooth and rounded edge. The bulbs are now passed through the annealing furnace, taking an average of 1¼ minutes to pass through on a belt conveyor, and during that time are raised to approximately 500 deg. C. and then cooled to approximately 300 deg. C. while being carried by a cooling conveyor to the inspection table, whereon they are examined before they are packed for dispatch to Rugby.

In addition to bulbs, glass tubing and rod are manufactured at Chesterfield by automatic machinery, for dispatch to Rugby, where they are employed in the manufacture of "the stem." Caps are also made at Chesterfield by stamping from strip brass. At Rugby, as at Chesterfield, most of the processes are carried out by ingenious machinery. The first process is the building of the stem, the four components of which are all fed on to a large multi-head rotary machine, designed to manipulate them and (by repeated heating) to melt the glass at certain points in order to form them together, the completed stem being automatically ejected and conveyed to an annealer. Then the hubs on the "cane" are heated and, while the glass is plastic, the filament supports are inserted, the ends of the supports being cut and looped to suit the type of filament to be used, these operations being performed on yet another machine. The "mount," complete with filament and exhaust tube, is placed on to the head of the sealing-in machine, whilst an open-ended bulb (as received from Chesterfield) is fed over the mount into a bushing which holds it in the correct position. The neck of the bulb and the glass flare of the stem are heated at the point where they coincide, causing the two to unite and form an air-tight seal, the superfluous glass being melted off. The lamps are next placed on a rotary machine and the air is extracted by mechanical rotary oil pumps; capping and flashing are carried out on a semi-automatic machine, the lead wires being soldered automatically by machines to the cap contacts.

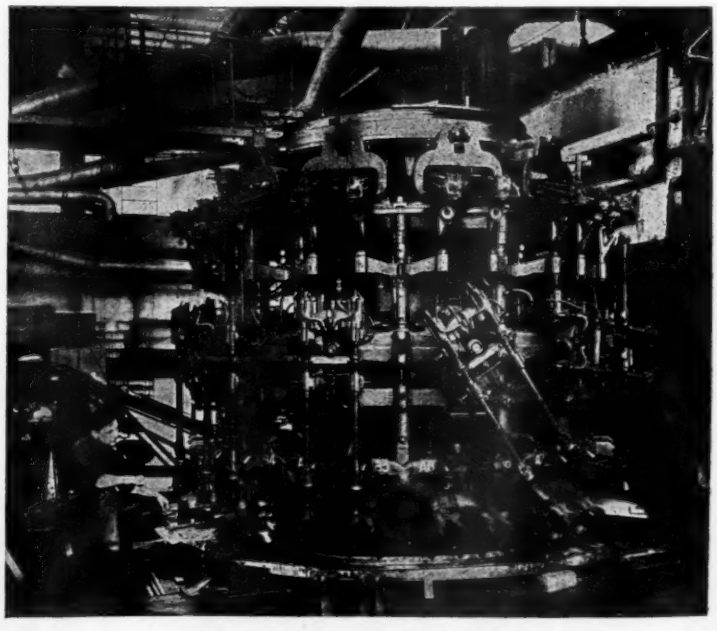


Fig. 1.—Electric Lamp Bulb-blowing Machine.

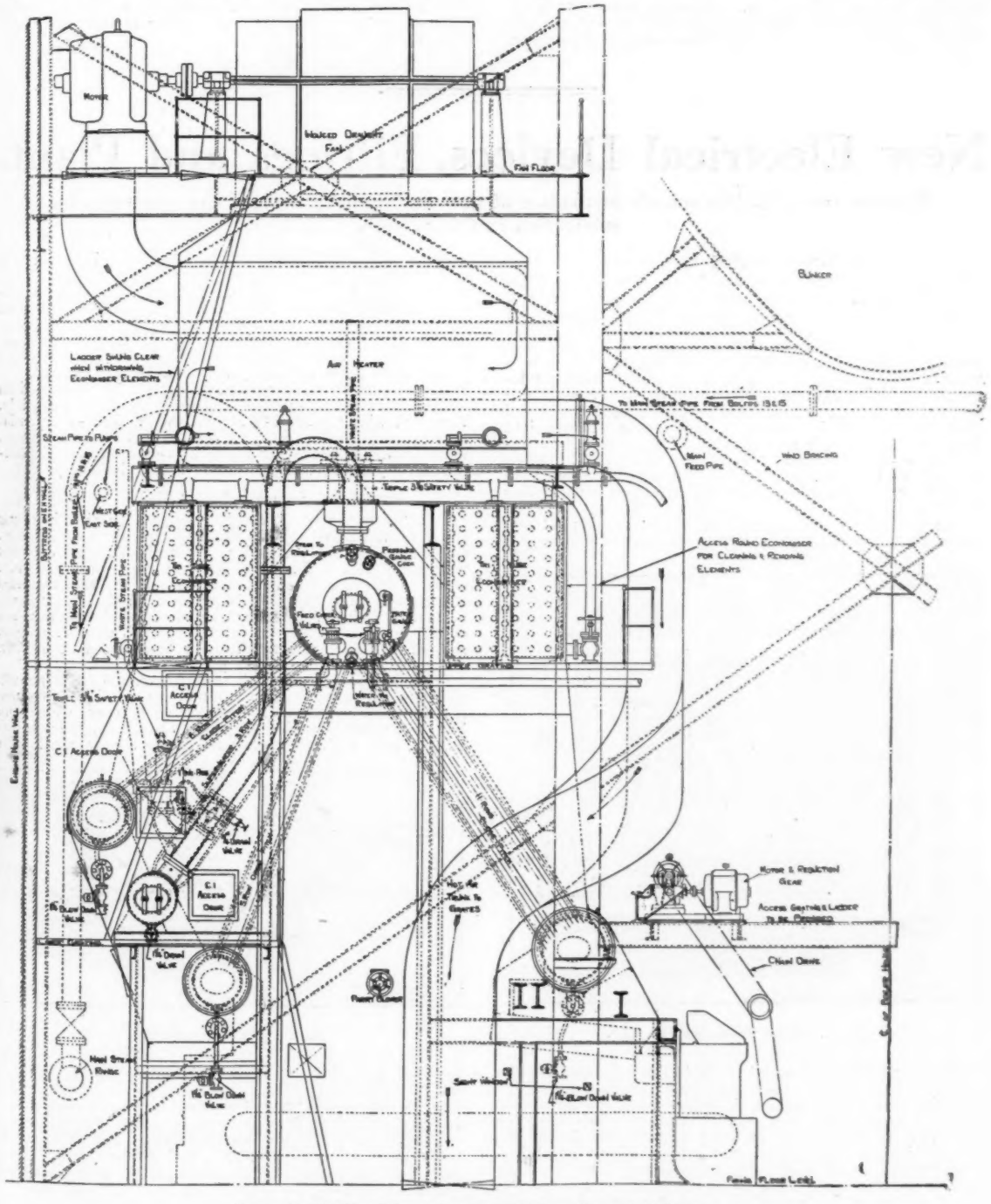
Modern Steam Boilers.

Some interesting features of the first two Yarrow boilers completed for the extension at the City of London Electric Lighting Co.'s Bankside Station.

TWO water-tube boilers which have recently been completed by Messrs. Yarrow & Co., Ltd., at the City of London Electric Lighting Co.'s generating station at Bankside have some unusual and interesting features. They have been designed and constructed to the approval of Mr. Frank Bailey, joint managing director and chief engineer of the supply company, and they are claimed to represent the most up-to-date practice in modern land-boiler design.

The general lay-out of each unit is shown in the accompanying illustration. It comprises the boiler and superheater, with a superposed economiser and air-heater in series. The boiler is of the Yarrow double-flow type, in which the gases pass both sides of the saturated-steam drum at the front and back, the superheater being situated at the back between two nests of generating tubes. The economiser is of the Green cast-iron horizontal tri-tube type, and is arranged in two banks, one at the front and the other at the back of the steam drum. A Yarrow tubular-type air-heater is placed above the economiser, and is designed for the gases to pass vertically through its tubes, the air for the furnace passing horizontally round the outside of the tubes.

The fan floor carries a forced-draught and an induced-



Yarrow Double-Flow Boiler with Superposed Economiser and Air-heater.

draught fan, supplied by Messrs. James Keith & Blackman Co., Ltd., and also a steel chimney, so that the furnace is worked under balanced-draught conditions. The induced-draught fan, which is of the double-inlet type, has a damper arranged in each inlet, and the gases leaving the front and back of the boiler are suitably divisioned off to the fan. The operation of these dampers enables the amount of gases passing the back of the boiler to be varied, thereby giving control over the final steam superheat temperature.

The construction provides for an unusually large combustion chamber, and the great amount of boiler heating surface exposed to the furnace is an interesting feature. Two Bennis stokers are provided, each 8 ft. wide by 18 ft. long, while suspended arches of the Liptak double-suspension type are a special feature. The following are the principal particulars of each unit:—Generating heating surface, 9,700 sq. ft.; superheating surface, 2,000 sq. ft.; economiser surface, 1,880 sq. ft.; airheater surface, 8,700 sq. ft.; and grate area, 290 sq. ft.

At the official trial which was recently carried out the following results were obtained:—Water evaporated per hour, actual, 62,907 lb.; water evaporated per hour, from and at 212 deg. F., 78,500 lb.; working pressure, 262 lb. per sq. in; steam temperature, 613 deg. F.; feed temperature, 149 deg. F.; coal burned per hour, 7,694 lb.; mean CO_2 at chimney base, 12.7 per cent.; temperature of gases at chimney base, 383 deg. F.; mean air temperature under grates, 345 deg. F.; F.D. fan-motor input, 25 A; I.D. fan-motor input, 30 A. The gross overall efficiency, based on the gross calorific value of the coal, was 83.1 per cent.; and the net overall efficiency, based on the net or lower calorific value of the fuel, in accordance with the I.C.E. 1913 revised code, was 87 per cent.

A feature of the plant, from the operation point of view, is the flexibility and the ease with which the load can be varied.

We understand that two further and similar units are approaching completion at Bankside, and that the makers have just received the order for two additional boilers, in view of the successful trial on the first two, so that the entire boiler extension to the Bankside power house will consist of six Yarrow boilers.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A M.D. Averaging Recorder.

The correct measurement and registration of maximum demand has occupied the thoughts of power engineers and instrument makers for a long time, and it is interesting to learn that Messrs. ELLIOTT BROTHERS (LONDON), LTD., Central Buildings, Parker Street, Westminster, S.W.1, have now introduced the Elliott averaging recorder, fig. 1. The instrument is a combination of integrating and graphic recording instruments, giving the total kWh up to the time of reading, and also the maximum demand in kW averaged over some agreed time interval. The integrating portion consists of a standard integrating meter with an additional spindle arranged to project upwards. The top of this spindle carries an ingenious and original form of magnetic clutch, to which the successful operation of the graphic part of the instrument is due. This clutch consists of a disk of mild steel on which rests a small permanent magnet of the bar form. The connection between the magnet and plate is entirely magnetic, and the magnet

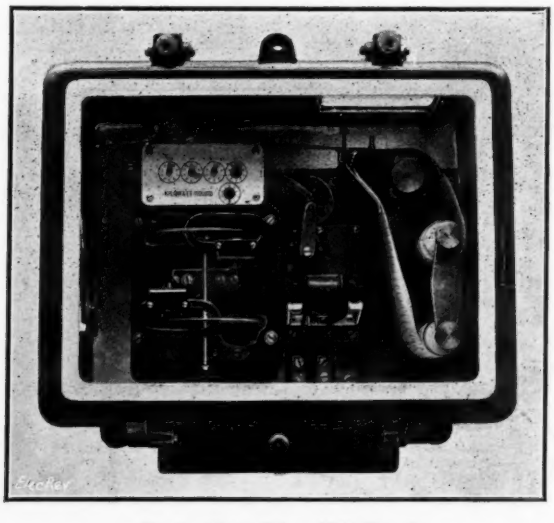


Fig. 1.—Motor Driven M.D. Recorder.

and the marking pen attached to it move forward as the disk is rotated by the meter elements. At the end of the definite time period a cam is released and allows a glass disk to rotate between a pair of contact fingers until the fingers make contact through a gap in the glass. An electromagnet is then energised, attracting an armature which brings the marking point of the pen into contact with the chart, and a fraction of a second later returns the pointer to zero, thus drawing a line across the chart, resetting the recorder for the next time period, and opening its own circuit. The chart is in the form of a series of lines sufficiently close together for the upper ends to form a curve of maximum demand. The pen is arranged so that the marking point is just clear of the paper and a large reservoir is provided, which, together with the spring stylograph nib, allows the recorder to run for long periods without attention. The chart paper is supplied in rolls 65 feet long, and is fed forward at a speed calculated to give the best chart marking. The instrument is made in two forms, namely, the synchronous-motor-driven pattern, as illustrated, and the clock-driven type. The former is the most suitable, especially when a large number of instruments are employed, as the synchronous-motor drive ensures that all averaging recorders connected to the system are absolutely synchronous in operation. It is claimed that the instrument will work for long periods without attention, and that the upkeep is practically negligible. The stock windings are 5-A current coils and 110-V potential windings. The instruments are intended to work off current transformers, and can, if required, be provided with self-contained pressure windings up to and including 650 V.

A Portable Power Unit.

The "Farmer's Boy," fig. 2, is a portable electric power unit, manufactured by Messrs. ELECTROMOTORS, LIMITED, Openshaw, Manchester, which has been designed specially for general farm work. It consists of a motor of about 5 h.p. chain driving a counter-shaft on which are mounted two pulleys. A third pulley is mounted on the motor shaft, so that a choice of three belt speeds is available, enabling all classes of machinery to be driven, such as chaff cutters, root slicers, dairy machinery, cake breakers, and, in fact, any machine on a farm where power is required.

In addition, a grindstone is mounted on the counter-shaft, so that agricultural implements may be readily sharpened. As the whole equipment is mounted on a truck, which can be moved about from place to place by one man, like a wheelbarrow, it is a simple matter to provide a convenient drive

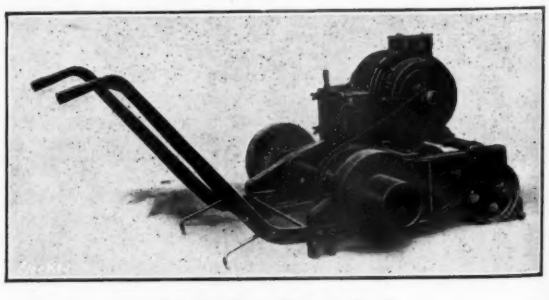


Fig. 2.—The "Farmer's Boy."

for any piece of machinery. It is only necessary to wheel the "Farmer's Boy" into position, give a reasonably tight belt, kick the chocks under the wheels, put the stake provided into the ground to prevent movement, and plug the length of flexible cable into the nearest socket. Being very simple and requiring no skill to operate, a "Farmer's Boy" should be a very useful machine on farms where there is electric supply available.

New Pedestal Switchgear.

A recent development of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is a range of pedestal oil-immersed switchgear for use where robust totally enclosed equipment is required. It is constructed on the lines of the G.E.C. flame-proof apparatus, but without the wide-flange feature of that class of gear. It consists essentially of an

oil circuit breaker mounted on a framework pedestal with a busbar or connecting chamber, and the necessary instruments, protective devices, cable boxes, and so on. The breaker can be either of the fixed or draw-out type. It has the free-handle feature and is made in three sizes with ratings of from 660 to 3,300 V, 50 to 1,000 A, and 7,500 to 50,000 kVA breaking capacity. For operating the breaker a side lever actuates a toggle mechanism of steel construction throughout. A long double break is provided on each phase, and the clearances comply with the B.E.S.A. specification. A factor of safety of more than 2 is allowed in the design of the breaker. The tank is divided into sections for the phases, and is fitted with an oil-level indicator. Self-aligning plug contacts are provided, having a maximum rating of 200 A; larger capacities than this are provided for by multiples of the contacts. A spherical end of the plug ensures, it is claimed, a very firm and reliable contact. The fixed contacts are of the renewable-finger type. Renewable auxiliary arcing contacts, finger pattern, are provided. Interlocking is em-

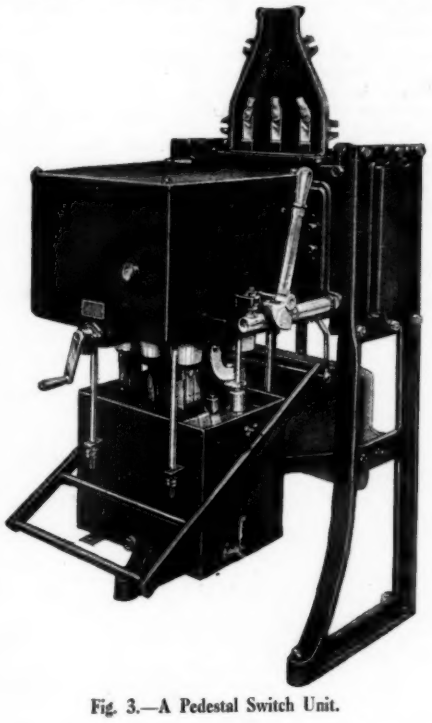


Fig. 3.—A Pedestal Switch Unit.

ployed where the breaker is of the draw-out type. The busbars are contained in cast-iron chambers, strip connections being taken to the stems of the isolating contacts. Side and top inspection covers are provided where cable boxes are not fitted. Fig. 3 shows a unit pedestal with some of the interior parts exposed. The units may be built up in switchboard form.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

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1,703. "Electric condensers with resistances." Dubilier Condenser Co. (1925). Ltd. August 4th, 1926. (275,081.)
3,112. "Electro-responsive time-element devices." British Thomson-Houston Co., Ltd. February 5th, 1926. (265,596.)
3,147. "Terminal-protecting device particularly for electricity meters." Landis & Gyr Soc. Anon. March 19th, 1926. (267,896.)
3,805. "Variable electric condensers." British Thomson-Houston Co., Ltd. February 10th, 1926. (265,980.)
6,123. "Impulse-repeating devices for automatic and semi-automatic telephone exchange systems." Telefonaktiebolaget L. M. Ericsson. March 9th, 1926. (267,499.)
7,218. "Telephone conductors." Siemens-Schuckertwerke Ges. March 16th, 1926. (267,932.)
7,306. "Combined electric heater and air purifier for domestic purposes." I. Eckmann. March 16th, 1927. (275,118.)
7,311. "Electrolyser diaphragms of the filter-press type." R. Pechkranz. May 14th, 1926. (271,043.)
8,177. "Tap-changing systems for electric transformers." Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1926. (268,765.)
11,244. "Burglar-alarm apparatus." M. W. Wakefield and P. A. Wakefield. April 27th, 1927. (275,128.)
11,882. "Wireless receiving or transmitting apparatus." W. Kindler. May 4th, 1927. (275,130.)
12,079. "Indicating systems for dynamo-electric machines adapted to be connected to a common bus bar." British Thomson-Houston Co., Ltd. May 21st, 1926. (271,443.)
15,121. "Methods of and apparatus for treating filaments for electric incandescent lamps or the like." British Thomson-Houston Co., Ltd. June 9th, 1926. (272,500.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 17th:—

Atlas. No. 464,282. Class 8. Electric batteries and parts thereof.—Atlas Carbon & Battery Co., Ltd., 56, Southwark Bridge Road, S.E.1.

Microtune. No. 477,602. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—J. Dyson, 57, Godwin Street, Bradford, Yorks.

Miller. No. 471,036. Class 13. Oil and electric lamps, electric lighting fittings and fixtures, &c.—Miller Co., Meriden, Conn., U.S.A. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Bell (lettering and design). No. 479,044. Class 13. Electric lamps (ordinary).—British Electric Lamps, Ltd., Spencer Hill Road, Wimbledon, S.W.19.

Nosco (lettering and design). No. 481,186. Class 13. Ordinary incandescent lamps.—Northern Steel & Hardware Co., Ltd., 1 and 3, Southgate, Deansgate, Manchester.

Nomet. No. 482,238. Class 40. Electric wire covered with indis-rubber. No. 482,239. Class 50. Wooden casing for electric cables, conductors and junction boxes made of bituminous compositions, or of synthetic resin or other phenol derivatives.—W. T. Henley's Telegraph Works Co., Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ANDOVER (Hants.).—Engineering works, Anna Valley, for Messrs. Taskers.

ASHFORD (Kent).—Dairy, Victoria Crescent, for the Co-operative Society, Ltd.; secretary. Warehouse, High Street, for W. H. Gibbs.

ASHINGTON.—Wesleyan Reform Union Church; Trustees.

AYR.—Cinema, High Street; Mr. Glen, architect.

BIRMINGHAM.—Extension of works, First Avenue, Stechford, for Parkinson Stove Co., Ltd. Extensions, George Dixon secondary school; Education Committee. Medical staff quarters, Selly Oak Hospital; C. Whitwell & Son, architects, 3, Newhall Street.

BLUNHAM (Bedford).—Factory, for the Beds. Beet Sugar Co.

BOGNOR.—Public offices, for the U.D.C.; surveyor.

BOLTON.—Premises in Deansgate, for Mr. Herbert Swaine and Messrs. Magee, Marshall & Co., Ltd.; Briggs and Thornley, architects. Extensions, Garfield Mill, Atherton Street; Kippax & Sons, Ltd. Paint store, Plover Street; J. Dickinson (Bolton), Ltd. Air filter house and heater house, Mealhouse Lane; Tillotsons, Ltd. Conversion of old church, Fern Street, to picture palace; T. Flintoff Moorhouse. Electric lighting, St. James School; Church of England managers.

CAR ISLE.—Extensions, Crown and County Courts, for the T.C.; Percy Dalton, city engineer.

CATTERICK CAMP (Richmond, Yorks.).—Soldiers' home (£50,000); Young & Mackenzie, architects, Belfast; Messrs. M'Laughlin, contractors, Belfast.

CORSHAM.—Business stores, for the Chippenham Co-operative Society, Ltd.; L. Gardner, architect, Hastings Road.

CROYDON.—Grammar school for boys, Haling Park, for the governors of the Whitgift Foundation; secretary.

CUDWORTH.—Primitive Methodist Church; Trustees.

DARLASTON.—Additional housing scheme (380), for the U.D.C.; housing architect.

DEVONPORT.—Welfare centre, Portland Place; Plymouth borough engineer.

DOUGLAS (I.O.M.).—Shed, Parade Street; I.O.M. Steam Packet Co., Ltd.

DUNFERMLINE.—Reconstruction of buildings at rubber works, for Messrs. R. W. Stewart & Co.; the manager. 52 houses for Corporation; burgh surveyor.

DURHAM.—County library headquarters, Old Elvet; county librarian.

EASTBOURNE.—Masonic Temple and business offices, South Street; Dr. Colgate. Additions, Town Hall; borough engineer.

GLASGOW.—194 houses, Bellahouston; city housing director.

HARTNEY WINTNEY (Hants.).—Housing scheme (30), for the R.D.C.; surveyor.

HESWALL (Birkenhead).—Electric light installation, Parish Church; James K. Wilkie, consulting engineer.

HEYWOOD.—Boiler-house, No. 2 Mill, Heap Bridge, for Yates, Duxbury & Sons, Ltd.

HORWICH.—Grocery branch premises for Horwich Industrial Co-operative Society, Ltd.; Law & Grimshaw, architects, Bank Chambers, Atherton.

HOUGHALL.—Farm buildings (£11,000); Durham County Agricultural Committee.

HULL.—Secondary and elementary schools; Director of Education, Guildhall.

JARROW.—Electrical laboratory, secondary school; Carruthers and Salt, South Shields.

KIRKCALDY.—Housing scheme (50), Woodend, Cardenden, for the District Committee; William Williamson, architect.

LEEDS.—Electrical work, Swinegate tram depôt extension; tramways manager. Estate development, Cross Gates; F. B. Atkinson.

LEICESTER.—95 houses for rehousing; city engineer.

LICHFIELD.—Electric wiring, 16 houses; Trent Valley Road, for the T.C.; P. A. Benn, city surveyor.

LIVERPOOL.—Bank premises, Water Street (£500,000), for Bank of Liverpool and Martins; H. J. Rowe, architect, Liverpool.

LONDON (Barking, E.).—Development, Faircross Estate; Estate Co. Factory, River Road; R. Orrock. Steel buildings, River Road; British Anti-Fouling Co., Ltd.

(Ilford, E.).—Nurses' home, Cranbrook Street; Committee, Ilford Emergency Hospital. Printing works, High Road; Kemeleys, surveyors. Electric supply, tennis pavilions, Goodmayes Park; Committee Aberdour Tennis Club.

(East Ham, E.).—Re-erection of factory, Ranelagh Road, for Bearns & Balfour; E. Schofield, manager. (Several thousand pounds.)

(Hornsey, N.).—Billiard hall, Middle Lane; G. Taft.

(Beckenham, S.E.).—Secondary school, for Kent E.C.; E. Salter Davies, director of education, Sessions House, Maidstone.

(Clapham Junction, S.W.).—Extensive alterations, for Arding & Hobbs, Ltd., drapers.

(Fulham, S.W.).—Building in Fulham Palace Road, between Crabtree Lane and Silverton Road; Wallis, Gilbert and Partners.

(Wimbledon, S.W.).—Warehouse and stores, Wandle Bank; A. J. Cripps & Co.

LYE AND WOLLESCOTE.—Housing scheme (52), for the U.D.C.; Hugh E. Folkes, architect, 34, Hagley Road, Stourbridge.

MORECAMBE.—Estate development, off Lancaster Road; G. Jackson.

NANTWICH.—Electric light installation, institution, for the B.G.; Mr. Atkinson, clerk.

NEWARK.—Workshops for technical school, Chauntry site; Notts. Education Committee.

NORTHAMPTON.—Garage and workshops, Cattle Market Road and Bridge Street; A. Milliner, Ltd. Extensions, factory, Spencer Street; H. Tomalin & Son.

OUNDLE.—Drill hall, quarters, &c., for Northants Territorial Army Association; J. W. Fisher, architect, Burystead Place, Wellingborough.

OXFORD.—Housing scheme (92), for the T.C.; J. F. Richardson, city engineer.

PAIGNTON.—Concert hall, Esplanade; U.D.C. surveyor.

PORTSMOUTH.—Factory extension, Dunbar Road; White and Newton.

PRESTWICH.—62 houses, Langley Estate; U.D.C. surveyor. 84 houses, Dickworth Estate; G. Benson & Son. Additions, Myrtle Grove Dye Works, George Street; J. and H. Bleakley, Ltd. Bank, Whittaker Lane; District Bank, Ltd.

RIVINGTON.—Extensions, Rivington and Blackrod Grammar School (£31,000); governors.

ST. HELENS (Lancs.).—New St. Luke's church (£17,000); Rev. F. H. Milward, incumbent.

SHEFFIELD.—Central fire station; W. G. Davies, city architect.

SPARKWELL.—Smallpox hospital; Plymouth borough engineer.

STOKE.—Engine house, Adkins Street, Cobridge; North Road Mill Co.

STRATHAVEN.—Sawmill premises, for J. & C. Fleming. (Several thousand pounds.)

TAUNTON.—Public baths (£10,000), for the T.C.; Roberts and Willman, architects.

TROWBRIDGE.—School, Newtown; Director of Education, County Education Offices.

TRURO.—Stores, Town Quay (£5,682), for the T.C.; J. H. Lobb, builder, Mevagissey.

WALSALL.—Nurses' home at the Infirmary (£20,000); J. R. Deacon, builder, Walsall.

WELLINGBOROUGH.—Extensive additions to works, Victoria Road, for the Ideal Clothiers Co.

YORK.—Electric lighting, Shipton Street school; Education Committee. 30 houses, Hope Street Improvement area; city engineer.